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THE CASCADE TUNNEL RAILWAY.

Dr. Hutchinson's admirable Institute paper on the electric system employed in the Cascade Tunnel of the Great Northern Railway Company is of particular interest as describing the first big three-phase traction plant put into operation in this country. American engineers have been inclined to turn the cold shoulder on the three-phase traction, particularly on a large scale. Their foreign confrères have, however, thoroughly demonstrated its success and anyone who has seen the smooth and beautiful performance of the Simplon Tunnel locomotives working on this system acquires abundant faith in three-phase traction for this heavy work. The Cascade Tunnel seems to have been a peculiarly suitable spot for the trial for three-phase traction in this country. It was in the first place such a tunnel where electric traction was acutely needed. Its range over 2½ miles was so great as to make the ventilation problem extremely difficult, and the considerable grade in the tunnel put such heavy work on the locomotives as to render the smoke danger somewhat appalling. When one realizes that the temperature in the locomotive cab rose at times as high as 200 deg. Fahr. in an atmosphere surcharged with smoke and gases from fuel, the seriousness of the situation is at once obvious. After considerable discussion it was decided to apply electric traction to the tunnel and to use the three-phase system as Dr. Hutchinson says, "on account of its greatest simplicity and less cost"; and it is pleasant to be able to record that experience since last July seems to bear out the wisdom of the choice. The locomotives are of the familiar articulated type, each section having two driving axles, to each of which a three-phase motor good for 375-hp continuous output is coupled by twin gears. The locomotive complete weighs 230,000 lb. and has been tested to a maximum tractive effort to nearly 80,000 lb. The primaries of these motors are the stators, wound for 500 volts. The motors are cooled by forced-air circulation.

The control system is of the simplest character, consisting of the familiar resistances in the rotors, a system which secures the variation on just about the same terms as with the old series direct-current motors with rheostatic control. The resistances themselves are iron grids having 13 steps. The total length of track electrified is about six miles and the overhead system is a cross-catenary suspension for the two working wires, so far as the parts of the track external to the tunnel are concerned. Within the tunnel the wires are supported from insulators projecting vertically downward a little over 5 ft. and carrying with them parallel to the wire a flexible link suspension from which the trolley wire proper is supported. Within the tunnel it was necessary from the standpoint of the railway company to space the wires 8 ft. apart in order to obviate danger to brakemen who might rest upon the tops of the freight cars. Hence, the otherwise very desirable bow trolley could not be conveniently used and heavy wheels are employed, but apparently give little trouble. The working efficiency of a locomotive is approximately 80 per cent, including gears, and

it is most interesting to record the fact that the power factor of the system as shown by the switchboard instrument in the power house is 85 per cent, which is excellent even for a 25-cycle plant like this one. The motor efficiency itself is very high, rising at the maximum to nearly 95 per cent, while the maximum power factor coincident with the motor efficiency of a little over 90 per cent is about 88 per cent. The total efficiency when the plant is delivering 4000 kw is 70 per cent from the low-tension busbars at the power house to the driving axles of the locomotive. Two locomotives are commonly used for the heavy trains. The typical train that goes through the tunnel is equivalent to a little short of 2000 tons, excluding the electric locomotives. On occasion three locomotives are set for the heaviest trains, while the passenger trains are ordinarily pulled by two, but one is sufficient in most instances.

The plant has now been in operation since July and there have been no delays in all this period due to failure in the electric locomotives. Two slight delays due to the transmission line are all that have been recorded against the plant, although for a short period trouble with the water-wheels led to complete suspension of the service. The east-bound service, which involves the grades, is now wholly handled by the electrics and the passenger trains west bound down-grade are so handled at the present time. There has been no trouble from the residual smoke in the tunnel due to the inactive locomotives hauled through it, although the trolley suspension is doubly insulated to give additional security against this element of mischief. The standard heavy-service locomotives used prior to the installation of the electric service require, according to Dr. Hutchinson's computations, nearly twice as much coal in proportion to the output as would be demanded in a steam station used on this plant in place of the hydroelectric station, and the locomotives here considered are compound locomotives of late type and admirable construction. In summing up the advantages of the system, Dr. Hutchinson lays great stress on the extreme electrical and mechanical simplicity and upon the enormous continuous output which can be obtained from the three-phase motors for a given space available in the locomotives. The electrical efficiency of the motors is high for a wide range of load. He also is of the opinion that the tendency to constant speed in the three-phase motor is a distinct advantage, especially in mountain service where the limitation of down-grade speed is sometimes of extreme importance. The matter of regeneration of power on down grades to which the three-phase system lends itself has not been gone into to any considerable extent in this plant. A 2500-ton train on the down grade would deliver about 1400 kw. Taken altogether, this initial three-phase plant for heavy traction seems to be doing sterling service and its future performance will be watched with great interest, particularly as it is expected that the electric service will be extended to the entire mountain division.

Electricity on the Farm.

Heretofore the electric light and power plants installed on farms have been rather scattered and sporadic. But it seems to be evident that there is bound to be a great increase in the number of electrical installations on the premises of well-to-do farmers. In these days there is really no reason why the farmer in comfortable circumstances, no matter where he may be located, should not have all the conveniences of a city residence in his home, with the added advantages of electric power to drive many kinds of farm machinery. The rapid advance of the gas engine with gas producers, or the gasoline engine, the possibilities of damming some creek or stream on the farm to produce sufficient power to run an electric generator, with the added consideration that the advent of the tungsten lamp has made it possible to secure electric lighting with a greatly decreased consumption of electrical energy, make it feasible for the farmer who is alive to modern opportunities to secure the advantages of electricity for light, power and heat at a not prohibitive cost. This tendency is greatly enhanced by the efforts of the great manufacturing combination which supplies the bulk of the agricultural machinery used in this country, as well as much that is exported. This great house, with its thousands of salesmen, catalogs gasoline engines and also supplies its men with price-sheets of gas engines, electric generators and motors and storage batteries. It will furnish the farmer anything he may need in this line. As the salesmen for this large organization penetrate to nearly every hamlet in the United States, they can and do exert an enormous influence for the introduction of electrical apparatus among the farmers. These salesmen are not electrical men, of course, but they carry with them a price-sheet so skilfully arranged that they can give an estimate of cost for a rural electrical equipment of almost any size, from 10 lamps up. Gas engines are used for power as a rule, and a special type of generator with flywheel is connected to them. Storage batteries are often included in the equipment, so that light may be had when the engine is not running.

Electricity is applied to feed-cutters, corn-shellers, pumps, grinders and other small machines in the farm power house, while it is more rarely used to operate field agricultural machinery, as plows, harrows, rakes, cultivators, binders, mowers, and the like. The threshing machine can be operated with advantage by electric energy when available. In the dairy, churns and cream separators are frequently electrically driven, and electricity is also used to milk the cows by the intervention of an air pump. From the little power plant electricity is supplied for lighting the house and premises, and the farmer's wife may have her electric flatirons as well as her sister in the city.

The number of electrical plants installed for farms is increasing with marked rapidity, and it seems probable that the time is coming when well-to-do farmers everywhere, no matter how remote from a city or village containing a central station, will consider electricity as a necessity. At first the current for these country equipments will be generated by plants on the premises; but as the movement becomes more general, central-station companies favorably situated will no doubt find it to their interest to extend their lines along the rural highways to a far greater degree than is done at present. In this a lesson might be taken from Northern Italy, some sections of which are networked with distribution lines for village and rural supply. The extension of the rural telephone has shown what can be done in this direction, and there is no reason to doubt that a similar extension of electric light and power circuits will gradually be made. The up-to-date farmers who are now putting in their own plants in increasing numbers are simply the pioneers who are demonstrating to the small central-station companies

scattered through the country that the farmers in the areas tributary to their plants want electricity and are willing to pay for it.

ELECTRIC POWER TRANSMISSION IN SOUTHERN FRANCE.

During the last 10 years there has gradually developed an extensive system of hydroelectric power transmission in the departments Bouches du Rhône, Basses Alpes, Var, and Alpes Maritimes, of Southern France, as detailed in a recent number of the *Elektrotechnische Zeitschrift* and abstracted in the Digest. The total amount of water-power available at the generators of the system is stated to be about 90,000 kw, with 21,000 kw of auxiliary reserve steam-power. The high-tension network extends from Arles nearly as far as the border of Italy on the Mediterranean Sea, including 600 km of high-tension lines. As at present projected, the network is expected ultimately to extend practically from the Italian to the Spanish border. The system is interesting not merely on account of its industrial importance to Southern France, but also on account of its electrical type. Hitherto the field of long-distance power transmission in France has been hotly contested by the high-tension direct-current system, and there are several examples of that system which have been in industrial service for some years. In fact, the advocates of the high-tension direct-current system have tried to exploit it in other parts of the world, basing their contentions upon its success in France and Switzerland. It cannot be denied that direct-current power can be carried at, say, a constant current strength of 100 amp, and a variable voltage up to, say, 100 kv, the power being generated in a single station and delivered to another single station. But the tendency of all modern hydroelectric systems is away from the single transmission line, and toward the multiple transmission network of lines, connecting a plurality of generating stations and delivery stations. This ramification network is quite unadapted to direct-current high-tension systems, whereas it is well adapted to the polyphase alternating-current system. It seems as though the triumph of the polyphase transmission system in the high-tension network of Southern France, with its eight generating stations and numerous consumption points, heralds the destiny of the direct-current system to disappear. The highest voltage in the Southern France system is stated to be 50 kv, which is coming to be regarded as a moderate voltage in this country. Shorter lines are operated at 30 kv, 13.5 kv and 10 kv. Secondary distribution circuits operate at 2200 volts, and tertiary distribution circuits at 230 volts and 115 volts. The frequencies employed are mainly 25 cycles per second for the long-distance transmission lines, and 50 cycles per second for the shorter transmissions. There is abundant evidence that no country remote from coal mines need despair of industrial development if it possesses high mountains and waterfalls.

GRAPHICAL METHODS FOR DETERMINING FLUX PATHS.

It fortunately happens that the formula for computing the electric resistance of a uniform straight wire of given length, cross-section and resistivity, is very easy, because the electric stream lines are all parallel to one another and to the axis of the wire, while the equipotential surfaces are consequently all equidistant planes perpendicular to the axis. The moment the conductor leaves the straight prismatic form, and disports itself in two dimensions, as, for example, where a straight wire terminates in a plate, we get into trouble in computing the resistance of the system, owing to the curvilinear form of the flux lines and equipotential lines; while if the conductor stretches itself into three dimensions, the computer generally shuts his book in despair. Nevertheless, there are certain cases of complicated flux distribution in which it is important to obtain a reasonably correct notion of the distribution. For example, in the case of water flowing over a dam, it is desirable for the engineer to know the contour of the stream lines of the water on the dam, in order that the surface of the dam may be made to correspond to a flow line, in which case there will be minimum friction, disturbance and tendency to erosion in the flow. Again, in the case of a dynamo machine, it is desirable that the designing engineer should know the distribution of the magnetic flux through the air, not merely in the air-gaps, but also in the stray paths surrounding the poles and teeth, in order to enable the amount of leakage flux to be computed, or the true reluctance in the magnetic circuit to be ascertained.

Unhappily, the general problem is one of great mathematical difficulty. It might, at first thought, be supposed that given, say, a set of known geometrical surfaces, between which flux passes—as, for example, the magnetic frame of a dynamo-machine—that it would be fairly easy to compute the distribution of the flux-paths in the three-dimensional space between them. So difficult is the task, however, that there are only comparatively few cases in which it has yet been worked out, and some of these present formulas that deter the engineer, owing to their complexity. It is a remarkable fact that we are constantly beset by fluxes of gravitational force, heat, electricity, magnetism, water and air, yet we are powerless to cope mathematically with the distribution of these fluxes, except in certain elementary cases. However, ground is being broken for the road of the engineer over this vast untraversed territory, by empirical methods which promise useful results. These new methods depend upon graphical cut-and-try processes, in such a manner that after the attempt has been made, the outlines carry their own evidences as to precision. If they are found to be seriously inaccurate, they can be erased and redrawn more nearly correct, and then used as stepping-stones to the next set of contours. One such plan has recently been developed for deriving the proper contour of a dam, by commencing with a known stream-line of water on the upper and free surface of the overflow, and then working down graphically into the water, to derive successive lower stream-lines, correcting the outlines as they are produced, by geometrical theories connecting curvilinear and equivalent rectilinear flow. The bottom stream-line, finally worked out graphically, is the best contour for the head of the dam. Another such plan has recently been suggested by Dr. Th. Lehmann, in an article abstracted in the Digest from the *Elektrotechnische Zeitschrift*, with particular reference to magnetic flux distribution in dynamo machines. Here again two-dimensional flow is discussed, and the air-spaces are laid out into equivalent cells of unit reluctance. A unit reluctance block in two-dimensional flow would have a length of 1 cm and a width of 1 cm. In curvilinear quadrilaterals, the sides are chosen, by compasses, to conform approximately to the equivalent unit-reluctance block of simple outline. As the graphical work advances, it develops its own checks and evidences of accuracy. The method is well worth studying.

Bell Telephone and Western Union.

As we go to press, the newspapers print what purports to be an official statement from Mr. Theodore N. Vail, president of the American Telephone & Telegraph Company, to the effect that the latter has purchased a substantial minority of the stock of the Western Union Telegraph Company. This appears to confirm many recent rumors that the telephone company was planning to take over the telegraph service of the country, having already a strong hold on the Postal Telegraph Company through the Mackay interest in that company.

Brailey Independent Telephone Situation.

Suit was entered at Cleveland, Ohio, on Nov. 9, against both the Cuyahoga Telephone Company and the United States Telephone, their transfer agents and the American Telegraph & Telephone Company to prevent the acquisition of the independent companies by the Bell interests. The suit against the Cuyahoga company was filed in the name of Mr. J. W. Otto, and in that of Mr. Samuel J. Schweer, of St. Louis, against the United States company. These men are supposed to represent the minority stockholders in the two companies who are seeking protection from any step that might be against their interests. Mr. Schweer filed a similar suit in the United States Court at St. Louis against the United States Telephone Company.

The defendants are the Cleveland Trust Company and the Mississippi Valley Trust Company, of St. Louis, with which the stock of the companies was deposited in 1906 under a voting trust agreement; the American Telephone & Telegraph Company, the Central Union Telephone Company and the Bell long-distance lines; voting trustees of the Cuyahoga Telephone Company, consisting of Messrs. H. A. Everett, E. W. Moore, B. Mahler, James S. Brailey, Jr., H. C. Stifel, M. C. Harvey, C. W. Wason, J. B. Hanna and H. R. Newcomb; and voting trustees of the United States Telephone Company, consisting of Messrs. A. H. Bauer, James S. Brailey, Jr., Clarence Brown, Claude Ashbrook, M. C. Harvey, J. B. Hoge, F. R. Huntington, H. A. Everett and E. W. Moore.

The petition explains the voting trust agreement entered into as a step to prevent the independent properties from falling into the hands of the Bell interests, 51 per cent of the stock being voted to that end. The services of the trust companies might be dispensed with at any time on vote of 90 per cent of the stock, and consolidation with other companies was prohibited by the agreement except on vote of all the voting trustees. The petition then states that Messrs. Everett, Moore and Brailey, and possibly others, sold the controlling interest to Brailey, who transferred it to the Bell people. When 90 per cent of the stock is thus acquired, it is stated, the voting trust will be abolished. While profits will go to the trustees who had part in the transaction, the minority stockholders will be ravaged and a monopoly will have been established.

An injunction against the Cleveland Trust Company and the Mississippi Valley Trust Company is asked to prevent them from delivering to any other parties the stock they hold, that the sale to Brailey be set aside, that the Bell people be restrained from receiving the stock, that the voting trustees be removed and that a receiver be appointed for the stock in question. Judge Vickery, of the Common Pleas Court, at Cleveland, issued a temporary restraining order to prevent the exchange of stock, and the same action was taken by Judge Williams in St. Louis.

In an interview following the filing of the suits Mr. James S. Brailey, Jr., stated that he welcomed a restraining order to prevent him from handing over the stock to the Bell interests, that they had not purchased a cent's worth of it and none would be delivered to them. He said that the identity of the interests associated with him were becoming known to the independent telephone men and that they are well satisfied. It is stated that the stock held by the Cleveland Trust Company has already been transferred. The only ground, it would seem, on which the sale of the stock could be set aside is that the voting trustees should know what was going to be done with it before they voted for the sale.

District meetings of the independent telephone men have been held in Cleveland, Toledo, Lima and other places within the past week or two, and at every one of them Brailey has reiterated the statement that no sale has been or will be made to the Bell people. A plan is on foot, however, to consolidate a number of the companies in Ohio in order to secure better control of the independent situation. There has always been a desire to keep them separate, but the conditions confronting them now is urging the matter of consolidation.

Some people believe that the Postal Telegraph Company is the actual purchaser of the stock of the two companies and the New Long-Distance Telephone Company, of Indiana, which Mr. Brailey has announced that he has lately acquired. This is merely a surmise, however, as no information can be secured by interested stockholders regarding the matter.

It is also rumored that a holding company will be organized to take over the companies of which Mr. Brailey has secured control and that it will hold the stock until such time as the actual purchasers desire to come to the front.

Central-Station and Power-House Insurance.

There has been considerable discussion of late over the question of insurance of electric traction and lighting properties. The original controversy arose over the question of commission for local agents. Risks written on properties in various places were frequently placed by owners in New York and other financial centers, and insurance brokers in these centers collected the commissions. This led to a protest from the local representatives of the companies in which the policies were written, who claimed that their territories were being invaded by outsiders. It has now practically been decided by all of the stock companies that hereafter, when risks are written outside of the location of the property, the outside broker shall divide his commission with the local agent.

This discussion has led to a plan on the part of Mr. H. N. Staats, who has been more or less identified with the insurance business, to organize two new companies, to be called the American Railway Insurance Company and the Electrical Insurance Company, the purpose of which will be the placing of all the risks on traction and lighting properties. According to Mr. Staats's plan, as it is understood, these two companies will take charge of the insurance of this class of property, and will place the majority of it with standard companies. The two new companies are expected to retain 25 per cent of all the risks. Mr. Staats claims that he has secured the consent of a number of the principal stock companies to this arrangement. Mr. E. H. A. Correa, vice-president of the Home Insurance Company, declares that his company will never have anything to do with this kind of an agreement, and that he does not believe many other standard companies will go into it. He says that the Staats companies, while organized with a capital stock, are in reality mutual, from the fact that it is expected that the stock shall be placed entirely with the owners of the traction and lighting properties that are to be insured. He also says that the old companies, which have large capital back of them, are ready to take the insurance on as reasonable terms as any new company can do, and he sees no reason why the brokerage should be divided.

Fire Insurance of Central-Station and Electric Railway Properties.

Representatives of a number of underwriters' associations of the country met in New York last week and organized the Central Traction & Lighting Bureau, which, it is planned, will handle all questions pertaining to insurance policies upon traction and central-station properties throughout the entire country. The meeting was held at the office of the National Board

of Fire Underwriters, and was the result of several months planning and negotiation. Among the associations represented were the Fire Underwriters' Union, the Western Union, Southeastern Underwriters' Association, Underwriters' Association of the Middle Department, Board of Fire Underwriters of the Pacific, Underwriters' Association of New York State, and the Board of Fire Underwriters of Allegheny County.

After having adopted a constitution and by-laws for the government of the new bureau, Mr. E. G. Richards, of the North British & Mercantile Insurance Company, was elected president, and General Agent Cofran, of the Hartford Fire Insurance Company at Chicago was elected vice-president. An executive committee was selected as follows: Messrs. R. M. Bissell, vice-president of the Hartford Fire Insurance Company; A. B. Andrews, manager of the Southeastern Underwriters' Association; Secretary Weiderhold, of the Underwriters' Association of the Middle Department; F. W. Jenness, secretary of the Underwriters' Association of New York State; George W. Law, of Law Bros., of Chicago, managers of the Western Department of the Royal Insurance Company of Liverpool; J. H. Lenehan, of Chicago, general agent of the Western & Southern Department of the Phenix Insurance Company of Brooklyn, and Charles G. Smith, secretary of the German-American and German Alliance Insurance companies of New York. At a subsequent meeting subcommittees were named and Mr. Bissell was chosen chairman of the executive committee and Mr. Smith vice-chairman. The secretary, who will be in active charge of the headquarters, has not as yet been chosen. The headquarters of the Bureau will be in New York City, but offices have not as yet been selected.

In speaking of the purpose of the Bureau, Mr. Charles G. Smith, one of the most prominent promoters, said that it was intended to govern and simplify the writing of risks upon traction and electric light and power properties. Heretofore, he said, these policies had always been subject to the various local boards throughout the country, involving varying conditions and lack of uniformity. In many instances properties scattered all over the country belong to the same owners, and it was confusing to have these varying conditions applied. Under the control of the Bureau, he said, the inspection of electric properties and the terms of policies would be made uniform. Official blanks would be furnished inspectors which would apply for all parts of the country alike, regardless of regulations of local organizations. He said that practically all of the insurance companies in this country were represented in the present movement, and that hereafter all risks taken on electric properties would be subject to the same conditions.

Bronx Electrical Inspection Bureau.

Commissioner O'Brien, of the Department of Water Supply, Gas and Electricity, New York City, announces the establishment on Dec. 1, 1909, of an independent office for the Bronx, to be located at the Municipal Building, 177th Street and Third Avenue.

The chief engineer of light and power has ordered Inspector Francis J. Fitzpatrick, with 21 years' experience in the department, to take charge.

On and after that date all applications for permits and certificates relating to work in the Bronx will be filed at the new office, instead of at the Park Row Building, Manhattan, as formerly, and all permits and certificates for the Bronx will be issued directly from the Municipal Building in the Bronx.

Inasmuch as heretofore it has been necessary for persons located in the upper part of the Bronx to journey clear across two boroughs to transact business with the Bureau of Electrical Inspection, it is hoped that this change will operate to the convenience of the public.

For many years the Bronx office has been a suboffice merely, and much interchange of papers between the Municipal Building and the Park Row Building has been necessary. Delays attributable to this cause will be eliminated after Dec. 1.

Quebec Electrical Companies Consolidate.

A merger of power and lighting and street railway companies operating in Quebec and adjoining territory has been effected at Montreal, the negotiations having been completed on Nov. 10. Application has been made to the Dominion Government for incorporation of the Quebec Railway, Light, Heat & Power Company, with a capital of $10,000,000.

The companies which will be taken into the combination of interests are the Quebec Railway & Power Company, whose directors have been the moving spirits in the consolidation; the Jacques Cartier Power Company; Quebec Gas Company; Frontenac Gas Company; Canadian Electric Light & Power Company, operating in Levis on the south shore opposite Quebec; the Seven Falls Company, owned by the Quebec Power Company, and a number of lesser concerns.

The controlling interests in the new organization are Senator Robert MacKay, Messrs. Rodolphe Forget, J. N. Greenshield, K. C., and W. G. Ross, managing director of the Montreal Street Railway Company, these gentlemen having a short time ago gained control of the Quebec Railway & Power Company. The principal executive head will be Mr. C. E. A. Carr, formerly manager of the Quebec Gas Company. Mr. Carr was for some years manager of the London Street Railway Company and later manager of the Helena (Mont.) Light & Traction Company. It is expected that the consolidation will be completed in time to enable the new company to commence business in January.

Chicago Traction Situation Discussed.

Mr. M. B. Hereley, traction expert for the city of Chicago, addressed the Electric Club of that city at the weekly luncheon Nov. 10. He gave a history of the local traction situation, mentioning that there were 140 miles of elevated railways and 800 miles of surface street railways in the city. He thinks that Chicago needs a unified system of street railway operation. There are now five elevated railways, two surface street-railway systems, besides several minor roads within the bounds of the municipality. The joint ownership and operation of these roads was advocated by Mr. Hereley. The proposed subway should not be definitely planned until the capacity of existing elevated and surface roads is ascertained with joint operation and through routing. To ascertain that capacity would not appreciably delay the beginning of work on the subways, for it could be determined in 90 days. When built, the subway, elevated and surface lines should be operated in conjunction. The surface roads should have the short-haul business preferably, the elevated roads the long-haul, while the subway should supplement both when their capacity is exhausted. The Union Loop should be abolished, for it is an anomaly to have a railway terminal or switchyard in the heart of the city. It will be but a few days now before the plans being prepared for the subway will be announced by the local transportation committee of the City Council. Mr. Hereley closed by speaking of the progress of the extensive work of rehabilitating the street railways of Chicago under the direction of the Board of Supervising Engineers.

In the discussion the point was brought up that surface cars, at any rate within the "loop" district, will stop at "near" crossings on and after April 1, 1910. To one question Mr. Hereley said that he thought the proposed subways would extend south to Twenty-second Street and north to Chicago Avenue. The question of the speed of automobiles was brought up. One member of the club said that as street cars are regulated as to speed, why not put a similar and effective regulation on automobiles, which are causing an alarming number of accidents? Mr. Hereley said that it would come with good grace from the Automobile Club to suggest some effective method of regulating automobile speed that would actually work out in practice. He pointed out, however, that the speed of automobiles is regulated by State law, while that of street cars is prescribed by municipal ordinance.

Proposed Electrification of Railroad Terminals in Chicago.

The local transportation committee of the Chicago City Council has the subject of the electrification of Chicago railroad terminals still under consideration, but at a recent meeting action was deferred in order to give the railroads opportunity to state in writing their position on the subject and send delegations to address the committee if they desire to do so.

Delegations of railroad trainmen—conductors, brakemen, engineers, firemen and switchmen—are making known their opposition to electrification. They deny that their action is inspired by their employers, but assert that electrification would increase the danger of railroad operation to employees and also that many of them would lose their positions. This possible loss of employment seems to be the principal apprehension; but it is also contended that the third-rail, even if protected, is a source of danger, while, if the overhead trolley wire is used, men standing on cars are apt to be struck by the sagging wire. The men seem to think that it is impracticable to switch cars without men standing on the car roofs.

Railroad electrification has been brought up in the executive committee of the influential Chicago Association of Commerce, which is formed of the leading business men of the city, and has about 3000 members. The committee referred the subject to a special committee to report upon the general problem of railroad terminal electrification. This committee consists of Mr. A. Bement, consulting engineer; Mr. W. L. Abbott, chief operating engineer, Commonwealth Edison Company; Mr. Bion J. Arnold, chairman of Board of Supervising Engineers, Chicago Traction; Mr. Paul P. Bird, smoke inspector; Dr. W. F. M. Goss, dean of College of Engineering, University of Illinois; Prof. Charles E. Merriam, Chicago University, and alderman from Seventh Ward, and Mr. John M. Ewen, consulting engineer and building contractor. Mr. Ewen is the chairman of this strong committee, whose report will be awaited with interest.

Central-Station Power for Railroad Traction.

Contracts have been closed with the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., by the Baltimore & Ohio Railroad Company for electric power to operate its trains through the Belt Line tunnel, and by the Maryland Electric Railways Company to operate all of its trains running between Baltimore and Annapolis. The Belt Line's power house at Camden station will be maintained to light the Camden roads, the station and various other buildings, and to supply power to stationary motors.

With the exception of the United Railways of Baltimore, these companies are the largest users of power in that city, and the signing of these contracts is a recognition of the fact that it is more economical to purchase energy from a modern central power station than to generate it in individual plants.

More power was required by the Baltimore & Ohio to provide for the rapidly increasing traffic and new electric locomotives which have been ordered by the railroad. The contract with the Maryland Electric Railways Company is an extension of a former contract. This company has, from the beginning of its electric service on the Annapolis Short Line, secured all of its power from the Consolidated Company. The Baltimore & Ohio office building has continuously used the service of the Consolidated Company for several thousand lamps and a number of electric motors of 100 hp and under.

Guessing Contest on Chicago Maximum Load.

For a number of years the employees of the Commonwealth Edison Company have been much interested in a guessing contest during the closing months of the year to see who would come nearest to the maximum load. This maximum is expected to occur between this time of the year and Christmas, and the 1909 contest is now on. Contestants, who must be connected with the company, contribute 50 cents to a pool on making their guesses, and not more than five guesses are accepted from any one person. When the exact maximum is determined by the statistical department the person who makes the most nearly correct guess will receive 50 per cent of the pool; the next nearest, 30 per cent, and the third 20 per cent. The load to be considered will be the maximum kilowatts generated by the company's stations plus the storage-battery discharge.

Some information given for the benefit of those wishing to enter the contest is, perhaps, of more general interest to outsiders than the contest itself. Thus, it is noted that the highest total output maximum up to Nov. 1, 1909, was on Oc. 28, 1909, nearly 131,090 kw. With this as a guide, and assuming the same rate of increase as last winter, the maximum for this winter would be 161,990 kw. If the rate of increase is the same as that of two years ago, the 1909 maximum will be 151,780 kw. The maximum as calculated in a careful estimate made by the statistical department of the company on May 7, 1909, was 147,150 kw. Estimates based on the increase in connected load for the year ended Oct. 2, 1909, would indicate a maximum of 148,150 kw.

These figures are not only interesting themselves, but the study given to them in connection with this contest indicates a keen interest in the growth of the company's output of electrical energy on the part of its employees.

Electric Railway Electrolysis.

The United States Bureau of Manufactures recently submitted for investigation by American consular officers in 10 of the largest European cities several questions on the subject of electric railway electrolysis submitted by Mr. E. N. Lake, chairman of the electrolysis committee in Chicago. A summary of the replies received is given in the following table:

City.	Permissible drop in potential over street railway return circuits.	Potential difference between track rails and contiguous pipes.	Electrical connections between negative return and contiguous pipes.
London	7 volts, maximum drop.	Pipes, + 1.4 volts; pipes,—4.2 volts.	Permitted under special regulation.
Paris	1 volt per kilometer; 5 volts maximum.	Average of 1 volt normal operation.	No information.
Berlin	No specific regulation.	No specific regulation.	Not permitted.
Vienna	5 to 7 volts at maximum traffic.	Maximum observed, 1 volt.	None used.
St. Petersburg	1.5 volts maximum in city; 3 volts maximum in suburbs.	No regulation	Not permitted.
Moscow	Maximum 1.5 volts in city; 3 volts in country.	Ditto.	Not used.
Glasgow	7 volts, maximum drop.	Maximum observed, less than 1 volt.	Permitted, but not practised.
Liverpool	Ditto.	Maximum, 4.5 volts.	None used.
Brussels	No specific regulation.	No specific regulation.	Ditto.
Christiania	Maximum drop about 10 volts.	Maximum about 5 volts.	No information.

The following notes taken from the information received from abroad are given in addition to the table:

Paris.—When electrical installations are in public highways or are for electric railways, applications for permits must contain complete information and specifications as to the proposed installation. These are passed upon by the several departments, and when permits are issued provision is made for close supervision by the Governmental department interested. A three-wire system at 1200 volts between trolley wires is permitted, provided the track rails are used as the neutral conductor. The resistance of a rail joint, where the track is used for return circuit, must not be greater than that of 10 m (32.8 ft.) of unjointed rail.

Berlin.—Grounding of rails to earth or to pipes is not permitted, and artificial earth plates are prohibited. The city

exercises a supervision over the matter of potential differences in the earth through the official engineers. No specific potential differences or potential drops are mentioned in the requirequirements, but power is reserved by the city to investigate and prescribe in accordance with the conditions applying to each individual case.

Vienna.—The license regulations of the Austrian railway ministry provide for supervision of the return circuit conditions in a manner similar to that noted with reference to Berlin except that in Vienna there is a municipal street-railway system. A periodical examination is made by means of a test car of the electrical condition of track joints and return circuits.

St. Petersburg.—The maximum potential drop in return circuits was originally specified as 5 volts per verst in suburbs and 2½ volts in city. This is equal to about 7.5 volts and 3¾ volts per mile, respectively. This is now 3 volts and 1½ volts maximum between any two points on the system.

Moscow.—Equalizing rheostats are used in the negative return cables. Underground pipe systems are divided into sections by insulating joints.

Glasgow.—The Glasgow authorities consider the Board of Trade regulation of 7 volts maximum drop between any two points of the return circuit as far too high, and have limited their drop to 2 volts and 3 volts. The lead sheaths of their own cables are connected by the tramway department to the track rails at every manhole, or at an average interval of about 350 ft.

Liverpool.—Board of Trade regulations apply and are the same as in London.

Brussels.—There is only a general regulation without specific requirements as to potential differences or drops, which provide that the electrical conductivity of the return shall be such as to avoid all harmful "electrolytic actions."

Christiania.—In addition to the bonded rails for the return circuit an auxiliary copper conductor, about No. 8 B. & S. gage, is soldered to the bonds at each rail joint.

London.—Return feeders may be uninsulated if laid within 3 ft. of the track rails and electrically connected thereto at intervals of not more than 100 ft.; otherwise they must be insulated unless they are of such sectional area that they will reduce the difference of potential between the ends of the uninsulated parts of the return below the maximum limit of 7 volts. If any part of the return circuit is uninsulated it must be connected with the negative terminal of the generator, and the negative of the generator must also be grounded through an ammeter to two separate earth connections, one of which may be a water main.

Boston Electrical Show.

The Boston Electrical Show was opened with great enthusiasm on the evening of Nov. 15, in the presence of thousands of visitors from all parts of eastern New England. Special electric cars were run to the Mechanics' Building from the city and suburban points reached by the Boston Elevated Railway Company, and hundreds of interested persons lined Huntington Avenue as the doors were opened to the public. A special installation of flaming arc lamps was thrown into service in the early evening on the trolley poles in the center of Huntington Avenue, creating a thoroughfare of light for a distance of half a mile on each side of the Exhibition Hall. Flaming arcs on the roof also drew attention to the exhibition.

At 5 p. m. a meeting of the Massachusetts Press Association was held at Talbot Hall, adjoining the exhibition space, and at 6 o'clock 250 newspaper men and their wives, with employees of the Edison Electric Illuminating Company of Boston, proceeded into the banquet hall as the guests of the company at dinner. At the conclusion of the banquet an address of welcome was given by General Superintendent W. H. Atkins, of the Edison Company. President George C. Fairbanks, of the Massachusetts Press Association, made a felicitous reply. The entire company then adjourned to the Exhibition Hall and witnessed the opening of the show to the public.

The decorations and lighting of the hall combine artistic and utilitarian effects. The center of interest was a superb Italian garden erected and maintained by the Boston Edison Company. Here young ladies in Italian costume, representing the 33 municipalities of the company's territory, received guests. Each visitor on registering was presented with a handsome booklet describing his home city. A troupe of seven Italian musicians furnished entertainment during the evening, and by the use of dimmers and switches a moonlight effect of unusual beauty was produced. Many of the higher officers of the company were present as hosts to the throng which visited the show on its opening night. The exhibits, floors and galleries were filled with an interested crowd throughout the entire evening.

Lightning Arrester Experience at Colorado Convention.

As is usual, the Colorado Electric Light, Power and Railway Association held an experience meeting on lightning arresters at its recent annual convention in Denver. Mr. John A. Clay, manager of the Animas Power & Water Company, operating in the Silverton district, at very high altitudes, where lightning troubles are the most severe in the State, last year gave the results of his first experience with aluminum-cell arresters, which was very satisfactory. This year he was called upon to tell the convention his experience down to date with the aluminum arrester and other lightning troubles. An account of discharges has been kept at one of the substations by recording the discharges on the arrester on the telephone line on the same transmission poles. It has been found that discharges on the transmission line arresters occur at the same time as on the telephone arresters. At the Silverton substation previous to installing the aluminum-cell arresters there were a number of lightning discharges on the high-tension busbars. The past season there had been none. This season on one line there had been one shut down due to lightning where the aluminum arresters were installed. This was probably a direct stroke.

Mr. W. T. Wallace, of the Colorado Light & Power Company, transmitting from Canon City to Cripple Creek, reported not as much trouble as usual this season. Aluminum arresters had been used this year. He thinks that the ends of the lines and the low points must have arresters if there is to be protection. His lines are sometimes run past a substation several poles and arresters placed at the end.

Mr. W. N. Clark, of Victor, reported that the Pueblo & Suburban Traction & Lighting Company on its high tension lines over the mountains has had the aluminum-cell arresters installed on a 24,000-volt line into Cripple Creek. These arresters have improved conditions, but they cannot be depended upon to protect the line from breaking of insulators by lightning for more than a few miles each side of the arresters. Most trouble has been experienced with a 6600-volt distribution system in the Cripple Creek district. The aluminum arresters have helped, however.

The Engineer and the Community.

At the annual commencement of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., Dr. William McClellan, vice-president of the Campion-McClellan Company, New York City, in an address entitled "The Engineer and the Community," examined into the cause of the relatively minor professional status of the engineer in the eyes of the public, which he considered resulted to some extent from the present system of engineering education.

Addressing the graduates, he said that they will find that the world does not look on their profession the same as on that of the law, the ministry, or medicine. "You will find that the engineer seldom takes part in public affairs. You will find that in the great majority of cases the engineer is in the position of a trusted employee or adviser, but seldom has complete control of affairs with which he is connected. You will hear him

called narrow in his ideas, lacking in comprehensiveness, and not to be trusted with administration. In this or that situation, a 'man of affairs' is needed, which an engineer is not. Finally, you will note a great agitation among engineers in general that they are not receiving proper recognition from the community in view of their knowledge and experience. Why should such a condition of things be? Why should engineers be complaining, and the community apparently unresponsive?"

After reviewing the many reasons which have been offered to account for the public view of the engineer, he says that this view is confirmed by the action of many engineers in keeping hard after the material things, and that there is no question that the engineer has a tendency to become absorbed in his work and forgetful of other relations.

"Compelled as he is to pay great attention to details, he is prone to get his eyes too close and lose all perspective and comprehensiveness. His relations to large undertakings which he is discussing with financiers, owners, lawyers, promoters, and the like, are often to make sure that every link is sufficiently strong and in thus necessarily delving into detail he is likely to give false impressions as to his whole faculties. The lawyer, minister, and doctor, all must attend to details no less than the engineer, but they all deal with men, their opinions and actions primarily, whereas the engineer deals with things, and herein lies the great difference.

"And then there are so many kinds of engineers, mechanical, electrical, civil, hydraulic, mining, military, marine, illuminating, heating and ventilating, and so on, ad nauseam, like so many trades. How many times have I seen bright, educated, young electrical engineers who could not calculate whether certain floor beams could carry the generator they wish to erect on them. I have seen young civil engineers who did not know an ampere from a horse-power, and wondered how heavy a kilowatt was. There are various divisions in the medical profession, but all study medicine and specialize afterward. The law has many departments, but all study practically the same fundamentals at school and specialize in practice. Engineering has been different because of its origin from the mechanic, and our methods have unconsciously fostered this condition. The profession of engineering stands as it does, because in reality it has not unity as a profession. We have still to develop it—not mechanical, electrical, etc., mind you, but *engineering,* using this term in its widest sense."

Taking up the subject of improving the status of the engineer, Dr. McClellan says it is, of course, assumed that he needs a general education in the humanities just as much as any man. These, however, have more to do with making him a man than with making him an engineer, but a certain minimum amount of this work in general culture must be a part of every engineer's training. The real solution, however, appears to lie, first, in training men to become *engineers*—not mechanical, civil, electrical, etc., but *engineers;* and second, in teaching them at school what they cannot acquire after graduation without great difficulty—namely, fundamental principles.

"I say, train men to become *engineers,* and it cannot be said too emphatically. Let us not have a misunderstanding. Men will always specialize, and will always know considerably more of one subject than another. But the specializing in education should begin late. Every student should come out thoroughly drilled in the fundamental laws and principles of mechanics, mechanics of materials, hydromechanics, heat and thermodynamics, light, and electricity. These should be taught and retaught with example and experiment intensively, not extensively. It matters little whether a man has spent much time in school on the transformer if he has been drilled and drilled in the principles of alternating current and electromagnetic induction. The transformer, induction motor, etc., are easy after that. If a man has been well grounded in mechanics, stress, strain, and elasticity, instead of designing imaginary suspension bridges with a Carnegie Handbook, he will understand what we mean when we tell him in the office that reinforced concrete design is the same as plate girder design. Let us not try to turn out classroom engineers, for the offices do not want them, and no sane chief would trust fledglings. What we want are men who know fundamental principles of all engineering and are not half-educated, lop-sided mechanical, civil, and electrical mechanics. A man will find it hard to get these principles after he leaves school, but if he has them practice will get him everything else he needs and make him an engineer.

"I believe in this feature so thoroughly that I would abolish all departmental degrees, and give all graduates the one degree of 'Bachelor of Science in Engineering,' and I would see to it that he had a right to this title in its broad sense. Beyond this, I would not have the school go, but would leave the higher degree of 'Engineer' to his fellows who could properly estimate his practice. I think to-day that full membership in the American Society of Civil Engineers is considered more valuable than any college degree of C. E."

Referring to the present methods of engineering education, he says that in all engineering courses many subjects aside from those specifically attaching to the practice of a given profession are studied by means of lectures, recitations, and experiments in the departments of physics and chemistry. "Somehow the student gets the idea that in these departments the subjects suddenly become theoretical or abstruse, and will have little value for him in his practical engineering work. He does the work in the physical laboratory and in the chemical laboratory in a rather perfunctory way. He even hears men in the engineering department say that 'over there' it is not taught right for engineers, and that it is more or less useless. Then when he comes out and strikes the real problems, he finds in 9 cases out of 10 that those are the very things that he needs, and that the hours and hours he spent on so-called practical things are of no use to him in the commercial world. It is very likely to have quite different methods which he must learn anyway. In the meantime he has lost his only opportunity to get laws, and fundamental relations, not handbook formulas, well arranged in his mind."

Concerning the claim sometimes made that all teaching of subjects to engineers should be done by engineers or from the standpoint of engineers, Dr. McClellan says there could be no greater fallacy. "A man develops largely by the absorption of ideas from others, and by the study of their ideals. If he is trained wholly by engineers and from their standpoint, he is very likely to be one-sided, strongly developed along certain lines, and very deficiently along others. Perhaps English, for example, can be taught, as has been suggested, by the engineering instructors in connection with reports on experiments, but we shall be more hopeful if the teaching is placed in the hands of men who are primarily interested in good literature."

In conclusion Dr. McClellan says: "To sum it up, the schools, and we ourselves after we leave school, must distinguish between *engineers* and high-class mechanics, and must train *engineers.*"

Annual Dinner of the Electrical Trades Association of Chicago.

Held in the beautiful new University Club, with several speakers of distinction and with songs and good fellowship, the fourteenth annual meeting and dinner of the Electrical Trades Association of Chicago on Nov. 12 was successful in a business sense, as well as a pleasing social affair. After an excellent dinner had been served the president of the association, Mr. William A. Browne, presided at the brief annual meeting. The first order of business was the report of Mr. Frederic P. Vose, secretary and treasurer, who gave some interesting, and indeed, rather surprising, figures showing the extent of the association's activities. From this report the following facts are taken:

The Chicago association was established in 1896, in which year it had 18 members. The growth has been steady, until the membership for 1909 has reached 205. In 1896 21 claims were reported to the association on what is known as No. 2 form, amounting to $714.33. In 1909 the number of such claims was

3857, aggregating $338,423.68. During the 13 years of the association's existence the total number of claims reported on No. 2 forms was 23,537 and the amount involved was $1,741,661.30. The total claims reported confidentially to members for their mutual protection and to safeguard them against making unsatisfactory credits amounted in number to 2270 in 1909 and to 14,033 for the whole 13 years. The total claims adjusted and settled by the use of the association forms No. 3 and No. 6 were 2247 in 1909, the amount being $189,862.79. For the 13 years the total number of such claims was 14,640, and the total amount $1,184,979.29. The estimated amount of claims settled by the use of all the forms of the association since its organization amounts to the large total of $4,520,700.

The election of officers for the year 1909-1910 resulted as follows: President, Mr. Frank M. Pierce, Manhattan Electrical Supply Company; vice-president, Mr. Frank Horton, Moran & Hastings Manufacturing Company; national representative, Mr. James Wolff (re-elected), New York Insulated Wire Company. Mr. Vose, the secretary-treasurer, who conducts the affairs of the association so efficiently, is appointed by the executive committee. The two new members of the executive committee are: Mr. Thomas I. Stacey, Electric Appliance Company, and Mr. A. O. Kuehmsted, Gregory Electric Company. Mr. William A. Browne, M. B. Austin & Co., retiring president, was elected a member of the executive committee in place of Mr. Harry R. Parsons, resigned owing to removal from the city.

Mr. Pierce offered a resolution, which was adopted, raising the annual dues from $30 to $40 a year. The business of the association has become so extensive that the larger sum is considered necessary.

Mr. W. W. Low, of the Electric Appliance Company, urged a closer co-operation between the sales and credit departments of member companies. He brought up the question of uniform practice in the matter of cash discounts, and also of charging interest on overdue accounts, both of which he favored. After some discussion these subjects were referred to the executive committee.

There is a possibility that the name of the association may be changed to "Electrical Credit Association of Chicago," and, on motion of Mr. Wolff, the executive committee was authorized to make this change whenever the national association shall deem such a course advisable.

Mr. Kuehmsted urged that a concerted effort be made to increase the membership of the association, and he also moved a vote of thanks to the retiring officers, which was carried unanimously.

After the adjournment of the business session, Mr. Charles E. Brown, of the Central Electric Company, took charge of the dinner as toastmaster, and a number of excellent speeches were made. The first speaker was Mr. Samuel Insull, president of the Commonwealth Edison Company, whose subject was "Thirty Years of Electrical Development—1879-1909." Mr. Insull, who received a great ovation, gave in most interesting manner an account of the rise of the great electrical industry, with which his own experience has been coincident and with which he has been so conspicuously associated. He reviewed the progress of the art and paid a glowing tribute to Edison. A report of Mr. Insull's address will be printed in another issue.

The next speaker was Mr. James Wolff, national representative of the local association, who told of the organization and work accomplished by the national body. Mr. Wolff also gave a report of the action of the national association at the recent Boston convention, and he told of its bearing on the local bodies and its effect on individual members.

Judge Frederick L. Fake, Jr., of the Municipal Court, Chicago, with the subject "Observed from the Bench," was the next speaker introduced by Toastmaster Brown. The judge said that he had been very much impressed by Mr. Insull's address, and in a happy vein he reviewed some great historical events which might have been modified if the electrical inventions of to-day had been available in the past. For instance, the mind of Columbus, he thought, might have been greatly relieved in his first voyage of discovery across the Atlantic if he could have sent a "C. Q. D." message by wireless. The remainder of the judge's speech was principally devoted to an account of his interesting and varied experiences with humanity at the Harrison Street Police Court. He contrasted the United States Supreme Court, with its 300 or 400 cases a year, with the Harrison Street Court, where the speaker holds forth, and which passes often on 150 to 200 cases a day.

Mr. H. E. Hackenburg, treasurer of the National Carbon Company, Cleveland, took for his subject "Our Association." Referring to Mr. Insull's historical review, Mr. Hackenburg made the interesting statement that in 1882 copper-coated carbons made from coke for arc lamps, 7/16 in. in diameter and 12 in. long, sold for 10 cents apiece in lots of 1000. Carbons of the same type, but ½ in. in diameter, sold for 12 cents apiece. The speaker referred to the great value of the interchange of credit information, and praised the usefulness and efficiency of the association. He also told how sales orders were handled by his own organization.

Mr. C. E. Kremer, of the Chicago bar, was down for "The Humor of It," and he made a clever speech, interspersed with several good stories.

Mr. W. W. Low concluded the program with a bright speech in his characteristic vein, in which he said that the organization was doing a great work, of which he gave some instances. He had never attended a dinner, he said, which he enjoyed more, and, on his motion, thanks were extended to the committee in charge and to the toastmaster. After singing "Illinois," without which no banquet in that State is complete, the gathering dispersed. The entertainment committee in charge consisted of Messrs. W. P. Crockett, A. O. Kuehmsted, J. M. Gilchrist, W. P. Johnson and H. F. Holland.

Amortization Rule of New York Public Service Commission, Second District.

The following rule of the Jamestown (N. Y.) Light & Power Company for the treatment of the account "General Amortization—Electric" has been filed by Mr. Albert S. Price, secretary and treasurer, with the New York Public Service Commission, Second District:

"The Jamestown Lighting & Power Company, excluding the assessed value of the franchises and the estimated value of the real estate, estimates the replacement value of its remaining property conservatively at $80,000. We charge as amortization 3 per cent of this amount, or $2,400 annually. The operation is performed monthly by charging one-twelfth of the whole amount, or $200."

November Meeting of the New York Section of the I. E. S.

At the meeting of the New York Section of the Illuminating Engineering Society, held on Nov. 11, considerable discussion was given to the topic, "What Is an Illuminating Engineer?" The aesthetic and engineering features of the work were contrasted by Mr. Bassett Jones. Mr. W. H. Gardiner discussed the practical and theoretical features of the work, while Dr. A. H. Elliott called attention to the fact that engineering is concerned largely with the economies of the problem. None of the speakers offered a specific outline of the qualifications to be possessed by a person before he is entitled to assume the title of illuminating engineer.

A second question relating to the division of membership of the society brought forth marked differences of opinion as to the advisability of making a distinction between the members at the present time. Mr. E. L. Elliott, as chairman of the committee appointed to investigate the subject, stated that the committee's report at the next annual meeting will suggest changing the constitution so as to provide for a grade of membership to be known as fellows. A motion of Mr. A. J. Marshall, seconded by Mr. T. I. Jones, expressing the sentiment of

the New York Section in opposition to the division of membership as being premature, was carried with apparently no dissenting vote.

The secretary announced that the next meeting of the section will be held on Dec. 17 in Madison Square Garden in connection with the meeting of the National Commercial Gas Association. Papers will be read relating to gas lighting in Europe and to the illumination of the building of the Consolidated Gas Company, of New York.

Great Northern Railway Electric Equipment.

At a meeting of the American Institute of Electrical Engineers, held on Nov. 12, 1909, Dr. Cary T. Hutchinson presented a paper descriptive of the electric system of the Great Northern Railway Company at Cascade Tunnel. The section equipped for electric haulage is about six miles, 13,870 ft. of which is within the tunnel, where the track grade is 1.7 per cent. Use is made of three-phase locomotives designed for a speed of 15 miles per hour, which haul the trains through with their steam locomotives as dead loads. On account of the smoke and heat within the tunnel—the temperature at times reaching 200 deg. Fahr.—the traffic over the whole road was limited by the haulage through the tunnel. The electrical equipment has been designed for use over the total mountain section of 60 miles, throughout which there is an up-grade in each direction to the tunnel at the summit.

The locomotive built for the initial service has a total weight of 230,000 lb., all of which is on the drivers. There are two trucks connected by a coupling, each truck having two driving axles. To each axle there is connected by twin gears a 500-volt, 400-hp, 25-cycle, three-phase induction motor having a synchronous speed of 375 r.p.m. The gear ratio is 4.26 to 1, and with 60-in. drivers the no-load locomotive speed is 15.7 miles per hour. The motors are completely enclosed and air-cooled. Each locomotive is equipped with two 400-hp, three-phase transformers for reducing the e.m.f. from the trolley value of 6000 volts to 500 volts for the motors. The rating of the locomotive is put at 750 tons trailing load on the mountain division.

No provision is made for tandem, or concatenated, connection of the motors, the locomotive being designed for only one efficient running speed. By means of iron-grid rheostats in the secondary circuit of each motor the accelerating torque can be kept at the maximum value from standstill to the full running speed at constant power input and power factor. In passing from step to step on the controller a change is made in the resistance of only one secondary phase circuit at a time. The slight dissymmetry in the currents and elements of the torque is fully compensated by the gain in simplicity in control apparatus, 56 contactors being sufficient for the duty which would require 128 if a symmetrical arrangement were used.

For the three working conductors use is made of two overhead wires and the rails. Within the tunnel the overhead wires are placed 17.3 ft. above the top of the rail and 8 ft. apart, while external to the tunnel the contact wires are suspended 24 ft. above the rails and 5 ft. apart. The wide separation of the wires within the tunnel was selected in order to permit brakemen to walk upon the top of the freight cars. The change in separation from 8 ft. to 5 ft. dictated the use of trolley wheels instead of bow collectors.

The energy for the locomotive is derived from the Wenatchie River, the hydroelectric generating station being located about 2.5 miles west of Leavenworth. The power house is designed for three main 2500-kw units and two 125-kw exciter units; the latter two units and two of the former have been installed. The operating hydraulic head is 180 ft. An automatic water rheostat is installed in the power house for absorbing any excess energy generated by the three-phase locomotives when descending grades. When a train is on a down-grade the electrodes of the rheostat are automatically lowered by an amount proportional to the excess speed of the induction motors. Three 833-kw single-phase transformers, with a fourth for reserve, are used in the power house to increase the e.m.f. from the generator value of 6600 volts to 33,000 volts for transmission to a substation at the east portal of the tunnel; this substation contains transformers which are duplicates of those in the power house.

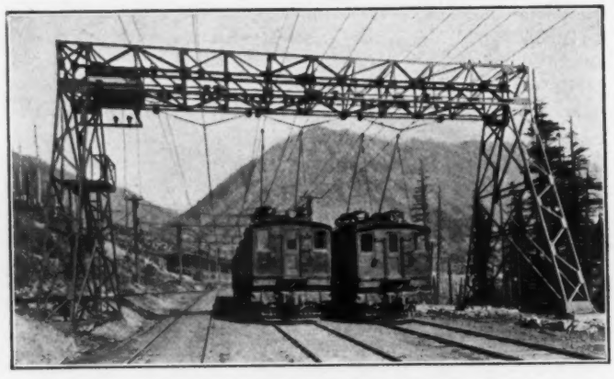
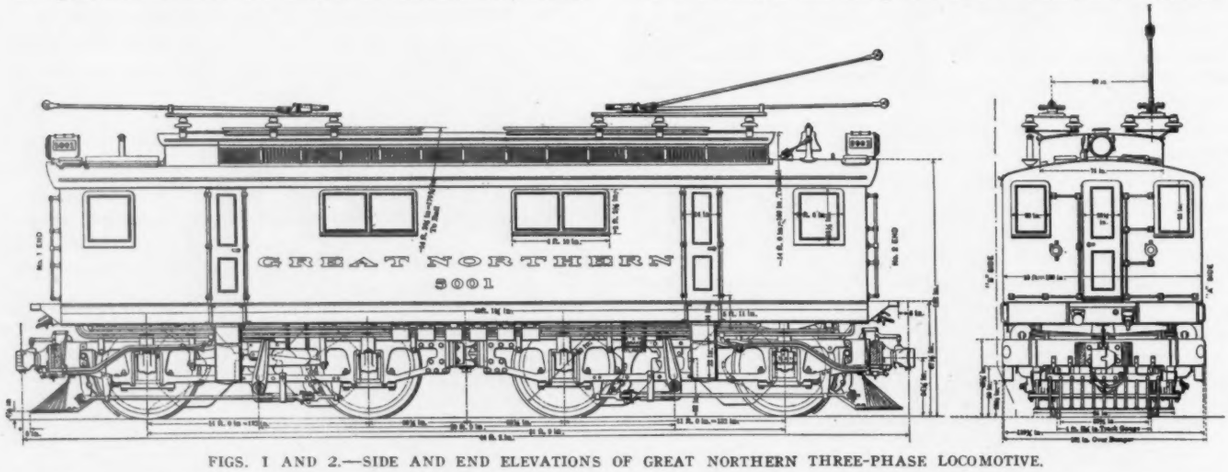


FIG. 3.—ANCHOR BRIDGE IN WELLINGTON YARD.



FIGS. 1 AND 2.—SIDE AND END ELEVATIONS OF GREAT NORTHERN THREE-PHASE LOCOMOTIVE.

The locomotives have been in service since July, and have caused no delay. There have been only two trifling delays due to the failure of the electric plant, both being chargeable to unavoidable accidents to the transmission line. The locomotive efficiency is approximately 80 per cent, and the efficiency of the whole system is about 70 per cent.

The author claimed that for the particular service for which it has been selected, the three-phase motor has marked advantages in specific output, reliability, simplicity and general trustworthiness when compared with any other motor.

The discussion was opened by Mr. W. S. Murray, who expressed his belief in the better service to be obtained in general railway work from single-phase motors, although admitting that for the Cascade Tunnel problem three-phase motors are excellent. The single-phase motor admits of maintaining nearly constant power input under varying conditions of grade, while an induction motor requires a load varying over exceedingly wide limits. When hauling a train up a 2.2 per cent grade the Cascade locomotives require from six to seven times as much power as when hauling the same train on level track.

Mr. E. B. Katte expressed the opinion that the use of direct-current locomotives with storage batteries would have made unnecessary the use of steam locomotives in starting the trains drawn by three-phase locomotives. Experience on the New Haven road has shown that the "flashing-over" voltage on insulators covered with soot, even when saturated with water, is several times the normal working e.m.f. of 11,000 volts.

Mr. J. B. Arnold stated that from a personal observation of the Cascade Tunnel three-phase installation he was led to conclude that it operated as successfully as any direct-current or single-phase installation he had even seen. However, in many cases the necessity for two overhead conductors with the three-phase would render a single-phase installation preferable, for example, where there are many yards.

Mr. F. N. Waterman called attention to a characteristic of the induction motor which renders it advantageous where many locomotives are used simultaneously. When the generating equipment is supplying energy to several locomotives, the starting of an additional locomotive does not increase the load on the station to the extent represented by the power taken by the locomotive, because the speed of the generators decreases and each of the locomotives already in service consume less power on account of the decreased frequency.

Mr. J. H. Davis compared the conditions at Cascade Tunnel with those existing in Baltimore, where direct-current locomotives have been in service for 14 years. In Baltimore the length of section equipped electrically is 3.7 miles, the ruling grade 1.5 per cent, the average grade 1 per cent, and the length of the longest tunnel 7400 ft.; there are 49 trains handled per day with a total tonnage of 36,230, as compared with 6.5 trains hauled at Cascade with a total weight of 8350 tons. The Baltimore service requires five 90-ton, 1100-hp passenger locomotives and five 80-ton, 800-hp freight units as compared with four 115-ton, 1900-hp locomotives at Cascade Tunnel.

Mr. L. R. Pomeroy gave estimates to show that the saving in coal consumption alone over a mountain section of a railroad would often pay for the necessary equipment for electrical operation. Recent annual reports from four railroads show that the average consumption of coal by a steam locomotive in actual service is from 9.6 lb. to 12.9 lb. per hp-hour, as compared with values of from 4 lb. to 8 lb. frequently reported from individual tests.

Mr. W. N. Smith said that in the Cascade Tunnel problem the disadvantages of the three-phase locomotive as to its constant speed and necessity for two trolley wires are at a minimum, while its advantages are at a maximum. He expressed the opinion that the next locomotives to be built for the Cascade installation, or a similar one, will be fitted either with pony wheels or with side-rods for coupling to motors placed on top of the frames.

Mr. F. S. Denneen explained that the self-supporting type of trolley construction was adopted on account of the necessity of insulating two overhead wires from each other and from grounds. Either of two insulators at each supporting point can fail without causing a break-down. In the tunnel the porcelain insulators are capable of working at 20,000 volts, and the wooden strain link at 10,000 volts.

Mr. W. I. Slichter outlined the limitation imposed by the necessity for constant accelerating torque and described the secondary rheostatic arrangement employed with the three-phase induction motors for producing this result. He stated that with the unbalanced arrangement adopted for the sake of simplicity, the torque per ampere is never less than 90 per cent of that with a balanced arrangement. During acceleration the tractive effort is kept within the limits of 41,000 lb. and 35,000 lb.

Mr. C. L. de Muralt stated that the three-phase system possesses advantages that will cause it to be used extensively. However, there is no universal electrical system, and both the single-phase and the direct-current systems will be used also. In the matter of efficiency, the three-phase systems is much ahead of the others, and especially so when recuperation of energy is availed of.

Mr. Calvert Townley remarked that the road installing the three-phase system will find that it has been advantageous to substitute electricity for steam, and the system will be extended. This fact is of much greater importance than any distinction between the several electric systems. Of all motors the polyphase induction is the simplest; for traction work it is somewhat disadvantageous in running economically at only one speed.

Dr. C. P. Steinmetz attributed to the development of the rotary converter in America the slow progress made in three-phase traction in this country. For general railway work, as now carried out, the three-phase locomotive is not so well suited as is the direct-current and the single-phase locomotives except in certain special locations. It is not self-evident, however, that the constant-speed method of operating trains would not be preferable to the variable-speed methods now in use. Doubtless the haulage capacity of the tracks could be increased by adopting the power method.

Mr. Frank J. Sprague called attention to the three railroad tunnels where electric traction has been introduced within the past years, namely, the Sarnia Tunnel with single-phase locomotives, the Detroit Tunnel with direct-current locomotives, and the Cascade Tunnel with three-phase locomotives. In each case electricity has successfully replaced steam by permitting higher speeds, higher capacity, greater safety and greater cleanliness. The speaker outlined the limitations in haulage along 140 miles of single-track of the Central Pacific Railroad over the Sierra Nevada, and expressed the opinion that this section will be provided with electric locomotives.

Massachusetts Commission News.

Hearings have been concluded by the Massachusetts Railroad Commission upon the petition of the Boston, Lowell & Lawrence Electric Railroad Company for permission to build a high-speed interurban railroad between the cities named in the company's title. At the final hearing on Nov. 12, arguments in opposition were heard by the commission from Mr. William H. Coolidge, counsel for the Boston & Maine Railroad; Mr. C. M. Hight, of Boston, for the Lexington & Boston Street Railway Company, and attorneys for the city of Somerville and the towns of Arlington and Winchester. In conclusion Counsel James F. Jackson and J. W. Farley argued on behalf of the petitioners.

Mr. Coolidge argued on the basis of the adequacy of the existing facilities, stating that there are already five steam lines and four trolley lines in the district. He urged that the running time of the proposed road will not be less than that of the present steam lines and that the fares will be higher than the existing commutation rates. He stated that there has been no complaint of the existing facilities, nor any recommendation by the commission that the present companies should modify their service, or that new facilities should be added on the existing lines.

Mr. C. M. Hight emphasized the injury to the earnings of that line which would follow the establishment of service by the new company.

Mr. Jackson emphasized the earnestness of the petitioners, and the improvement in the preparation of the present case, especially from the engineering point of view, compared with the first petition. He urged that the new road will furnish an entirely improved form of transportation; that the existing facilities cannot meet the need of the situation, and that the enterprise will benefit the present roads by its entrance into

the field and general stimulation of travel, aside from the releasing of present trackage for larger through service. Mr. Jackson said that President W. C. Brown, of the New York Central Lines, informed him within the past two weeks that electric railroads of the Boston, Lowell & Lawrence type will meet a need in general railroad work. Mr. Jackson said that the present steam roads show no evidence of intending to electrify their suburban lines out of Boston; that the Railroad Commission cannot order the companies to spend $20,000,000 for improvements; and even if the roads planned to electrify, it would have to be done by very slow degrees, and all sections would have to be treated alike. If the petition is refused, the people of Lowell and Lawrence will not see an electric train for 10 or 15 years to come. The contentions of the opposition in regard to interference with the present elevated traffic between Sullivan Square and Boston would prove unfounded after the terminal changes now planned were put into effect, and the use of more cars in the Boston elevated trains would help. Mr. Farley closed with a short review of the case and a discussion of the general demand for the road. The commission then took the case under advisement.

The Massachusetts Railroad and the Boston Transit Commissions gave a hearing as a joint board, on Nov. 11, on the various rapid transit measures referred to it by the Legislature of 1909. Mr. Moorfield Storey appeared on behalf of the Boston & Eastern Electric Railroad Company and urged the necessity of permitting that road to enter the city of Boston independently of the system of the Boston Elevated Railway Company. He argued that rapid transit would be defeated if a separate tunnel and subway were not authorized. The Public Franchise League of Boston was represented by Mr. Joseph B. Eastman.

Mr. Frederic E. Snow appeared for the Boston Elevated Railway Company. He contended that the company will stand committed to pay fixed charges on an investment of $111,000,000 by 1913, and that additional commitments to subway and tunnel construction cannot be made at present. Mr. Snow stated that the population of Boston and its immediate suburbs has not increased fast enough to compensate for the company's enormous increases in investment. During the past 10 years, by the most rigid economy, the company has been able to reduce the operating expenses per passenger from 3.62 cents to 3.46 cents. The enormous extension of the free transfer system has become a great handicap. Mr. Snow stated that in order to obtain the necessary revenue to enable the company to pay its reasonable dividends and charges patronage must be gained by the establishment of through service from points beyond the Boston Elevated system into Boston. He advocated a law to permit the Boston Elevated to own a controlling interest in the outlying companies, but urged that actual consolidation be avoided, in order to protect the 5-cent fare provision in the Boston Elevated charter. He urged approval of the Boston Elevated and the West End consolidation as a matter of the public interest, saving $600,000 a year in power plant charges alone. The Boston Elevated is not opposed to the Boston & Eastern project, except that it desires to handle all the traffic of the latter road within the city limits. The company contends that it cannot afford to maintain costly terminal facilities in Boston for the use of foreign companies. Concluding, Mr. Snow stated the prohibitive cost of building certain new subway and tunnel lines to the suburban districts of Boston, as proposed in various irresponsible bills filed with the last Legislature. In his opinion the demand for a $3,000,000 tunnel from Park Street to the South Station has been greatly exaggerated. The hearing was then closed, and the joint board will report its findings early in 1910.

New York Public Service Commission News.

With public ceremonies at which thousands of Brooklynites were in attendance, work was formally begun, Nov. 13, on the Fourth Avenue subway. Chairman Willcox, of the Public Service Commission of the First District of New York, turned the first spadeful of earth and there were speeches and merry-making. All of the six contracts for this work have been signed and the proper bonds executed. The contracts require that work must begin in 60 days and be completed in two years. At a banquet in Brooklyn, Mr. Willcox declared that the commission had in mind a comprehensive plan for connecting subways in the three principal boroughs of New York which included the Broadway-Lexington route in Manhattan and the Bronx and the Broadway-Lafayette route in Brooklyn. Mr. Willcox said that the extension of the Fourth Avenue route to Fort Hamilton and Coney Island would probably be undertaken at once and intimated that after that it would be easy by means of a tunnel under the Narrows to furnish rapid transit to the Borough of Richmond. Mr. Willcox expressed himself as in favor of the city building and owning the subways and thought that the earnings of the present subway showed that it would be a safe investment which would eventually return to the city a large revenue.

The commission received last week a letter from the Edison Electric Illuminating Company of Brooklyn offering to supply light and power to the Fourth Avenue subway which has just been undertaken. This communication, like the one from the New York Edison Company, received the week previous, was referred to the Committee of the Whole.

The Public Service Commission of the First District has adopted an order granting approval to the construction of the South Shore Traction Company's line through Queens Borough and across the Queensboro Bridge. This action was taken as soon as the decision of the Court of Appeals, ordering the commission to grant the franchise, was received.

The Board of Estimate granted last week a franchise to the New York & Queens County Railway Company to run its cars across the Queensboro Bridge, the matter having been already acted on by the Public Service Commission.

A hearing was held, Nov. 9, on the matter of regulations for heating closed cars in New York City in the winter season. All of the traction and rapid transit lines in Greater New York are interested in this matter and they were represented by counsel at the hearing. Mr. E. C. Connette, transportation engineer of the commission, testified that he had examined the cars of the New York & Queens County Railway Company. The metal cars, he said, were equipped with heaters entirely too small, which in two hours had only increased the temperature of the car 20 deg. In addition to this he expressed the opinion that the heater required for a metal car should be much larger than that of a wooden car of the same size on account of the conductivity and radiation of the metal car. The engineer suggested that further comparative tests be made.

Corporation Counsel Pendleton reported favorably last week to the Board of Estimate and Apportionment the preliminary contract with the Third Avenue Bridge Company, a subsidiary of the Third Avenue Railroad Company, giving it permission to run cars over the Queensboro Bridge. This contract lasts for 25 years and provides for transfers to all the lines of the Third Avenue Railroad. This is another franchise which the Public Service Commission has refused to sanction. Under the contract the city receives a percentage of the gross earnings.

Wisconsin Rate Commission News.

The Wisconsin commission has authorized the Northern Hydroelectric Power Company to issue $1,000,000 par value of bonds of the denomination of $1,000, which bear interest at the rate of 6 per cent per annum, payable semi-annually. The purposes for which the bonds are to be issued and sold are to supply the company with funds to pay its outstanding indebtedness; to construct dams at High and Johnson's Falls on the Peshtigo River, in Marinette County, Wisconsin; to construct power houses and substations; to purchase all necessary power-house machinery; to purchase all right-of-way; to construct all transmission lines, and to purchase all property incident to the construction of the plant of the company.

The Fort Atkinson Gas Company has been authorized to issue

$18,750 in bonds of various denominations, the funds received to be used for constructing a gas plant in Fort Atkinson.

The Burlington Heating Company has been authorized to issue $2,000 worth of stock for the purpose of supplying the company with funds for acquiring the necessary property and constructing a heating plant in the city of Burlington, Wis.

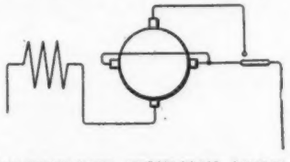
Canadian Hydroelectric Commission News.

Although the by-laws authorizing the town of Port Arthur to execute contract for power with the Hydroelectric Commission was passed by an overwhelming majority two weeks ago, the town is not yet free to make the contract. The Ontario & Michigan Power Company has made application for an injunction to restrain the town from entering into the contract with the commission, and argument was heard in the case at Toronto on Nov. 12. The judge granted an injunction preventing the city from entering into the contract with the commission until the trial of the action entered against the town to determine its right to make such a contract. The town has decided to ask the Court of Appeal next week for leave to appeal from the decision of Justice Clute. It is stated that the Hydroelectric Commission and the Attorney-General will become parties in the action on the appeal.

The decision of the judge was that although the by-law was published continuously for two weeks previous to the voting, it did not comply with the statute requirements. It did not contain estimates of cost of constructing, erecting, installing, and maintaining the buildings, works, plant, etc., for the purpose of supplying the amount of electrical power required by the municipality. Neither did it state the terms and conditions upon which such electrical power can be transmitted and supplied, nor the form of contract to be entered into between the municipal corporation and the commission, and no contract was ever furnished to the corporation by the commission.

Speed Control of Compensated Repulsion Motor.

For the purpose of changing conveniently the effective number of turns on the armature of a compensated repulsion motor Mr. Frederick Eichberg, of Berlin, Germany, has invented the



COMPENSATED REPULSION MOTOR.

arrangement shown in the accompanying illustration. The invention consists in employing the short-circuited brushes as one rotor terminal at starting, and employing the two brushes of the second set as the two terminals for running. When the switch is in the position shown one-half of the rotor turns are cut out of circuit; this is the starting position. When the switch is thrown into its other position for running, all of the rotor turns are in circuit. A United States patent covering this invention was issued on May 4, 1909.

Indiana Court Decides Against Municipal Merchandising.

An Indiana Circuit Court has overruled the demurrer of the city of Frankfort, Ind., to a complaint denying the city's right to engage in the sale of incandescent electric lamps. The court held that if a city had the right to engage in the sale of electric lamps, it had also the right to sell gas stoves and gas fixtures when gas was piped into houses in the city. The court also held that the city had no right to use money collected by taxation with which to purchase electric lamps for sale to the public to the detriment of electrical supply dealers.

CURRENT NEWS AND NOTES.

BALTIMORE UNDERGROUND DISTRIBUTION SERVICE.—A portion of the northwestern section of Baltimore is being changed from the overhead to the underground system and it is planned to furnish consumers in this section with alternating current. There will be two transformers to each block placed in manholes located at regular intervals. The residents of the section have been notified that the company will make connections for the new service by Feb. 15. It is planned to remove overhead wires and poles wherever practicable within the city, thereby rendering impossible the inconveniences that were encountered during the great blizzard of March 4.

CHICAGO ENGINEERS TO DISCUSS CIVIC IMPROVEMENTS.—The Engineers Club of Chicago, which has handsomely appointed rooms in the building of the Automobile Club, has begun a movement to enlist the interest and talents of the engineers of the city in the various plans for civic improvement pending in Chicago. The plan is to hold a series of monthly luncheons at which men of authority will speak on the subjects involved. At intermediate meetings the members of the club will discuss the engineering features of the projects. On Nov. 9 President F. A. Delano, of the Wabash Railroad, outlined his plan for a series of railroad passenger terminals at Twelfth Street.

AMERICAN SHOW-WINDOW LIGHTING IN LONDON.—Mr. H. G. Selfridge, formerly of Marshall Field & Company, Chicago, but now at the head of "Selfridge's," a modern department store in London, recently revisited his native country, and in the course of an interview on differences in merchandizing methods in England and in this country, made the following interesting statement: "We've done another thing we were told we couldn't do. We've had 'American' window displays and kept them brilliantly lighted at night. The other London shops don't do this; they have great iron shutters outside their windows and pull these down every afternoon at the close of business. It is a survival of the old days when it was not safe to leave windows unprotected."

GYROSCOPIC MONORAIL CAR.—A car 40 ft. in length, 10 ft. wide, 13 ft. high and weighing 22 tons, equipped with two 1500-lb. gyroscopes, has been operated successfully at Chatham, England, on the War Office grounds, by the inventor, Mr. Louis Brennen. The car is constructed according to the same plan as was the inventor's model which was shown in London about 18 months ago; it differs therefrom in being full-sized and capable of carrying 40 passengers. A gasoline engine is used for driving an electric generator which supplies energy for driving the gyroscopes and the propelling motors. It is stated that when all of the passengers on the car moved over to one side of it the car automatically adjusted itself to a new balance, by reason of the action of a pneumatic device controlled by the gyroscopes.

RADIUM INSTITUTE.—The Radium Institute of America has been incorporated in New York through the efforts of Prof. William Hallock, of Columbia University. The officers elected are: Dr. C. F. Chandler, president; Dr. Robert Abbé, vice-president; Prof. Hallock, secretary; Dr. G. B. Pegram, assistant secretary, and Dr. Hugo Lieber, treasurer. One important object of the Institute will be to explore the sources of radium and of radioactive minerals as they occur in the United States and to control them exclusively for philanthropic purposes. Waters which have radioactive properties will be examined. Among such waters which will be put to an official test are those of the Saratoga and Blue Lick springs. One of the principal objects will be the protection of the public from quackery, for, owing to the small supply of the substance, which is quoted at $18,000,000 a pound, unwarranted pretensions have been made by charlatans.

GAS-ENGINE SERVICE.—During the fourth annual meeting of the National Commercial Gas Association, which will be held at Madison Square Garden, New York, from Dec. 14 to 21, a paper entitled "Gas Engines in Competition with Central-Station Electric and Isolated Steam Plants" will be presented by Mr. W. W. Cummins.

UNIVERSITY OF COLORADO AUDITORIUM.—Plans and specifications are being drawn up for a fireproof auditorium building being constructed for the University of Colorado at Boulder, under the Mackay bequest. This building will be one of the finest university auditoriums in the country and the illuminating and stage control arrangements will embody the latest developments in such construction.

BALTIMORE N. E. L. A. SECTION.—The Baltimore Consolidated Electric Light & Power Company section of the N. E. L. A. is making every effort to increase its membership. At present the attendance at meetings is about 100, and recently the entire second floor of the Martland Telephone Building was secured for a meeting-place, where double that number can be accommodated. The entrance fee has been waived until Jan. 1, and a series of lectures being delivered by Prof. Sydney W. Ashe has largely increased the membership.

RETURN OF FARES TO DELAYED PASSENGERS.—By an ordinance recently passed by the Chicago City Council fares are to be returned to passengers when a surface or elevated car is delayed for 10 minutes or more. It does not appear to be clear whether fares must be refunded in case the delay is not the fault of the traction company, but is caused by a wagon breaking down on the tracks, a fire blockade or some similar cause. Hitherto, although the conductors have usually given transfers to the nearest available line by which passengers could resume their journey, there has been no ordinance requiring fares to be refunded.

OVERHEAD WIRES IN MADISON, WIS.—The City Council of Madison, Wis., has ordered the removal of all telegraph, telephone and electric light wires from State Street between the Capital Square and Park Street, a distance of nine blocks, Park Street from State Street to University Avenue, a distance of one block, and University Avenue from Park to Charter Street, a distance of five blocks. The poles must be moved by Aug. 10, and failure to do so by that time will make the companies liable to a fine of $10 to $100 a day for each day thereafter until it is done. It is stated that the Wisconsin Telephone Company will raise no objection to this ordinance. The Southern Wisconsin Traction Company is ordered to place iron trolley poles along its line on State Street and University Avenue, a total distance of 15 blocks. The same time limit and fines apply to this clause of the ordinance.

INDISCRIMINATE STREET EXCAVATION RESTRAINED.—In the future the Board of Local Improvements of the Chicago municipal government will send notices to all public-service corporations when a special assessment roll for the paving of a street is filed in court. Then if any corporation desires to do work in the street it must proceed with it within 60 days from the date of the notice. This rule will not apply to cases of emergency, such as the bursting of a water-main, in which event it is within the discretion of the commissioner of public works to award a permit. It would seem also that similar latitude must be allowed after the street has been paved for several years, and the growth of population requires an increase of public-service utilities. However, the main intent of the new regulation is to cause all the work required in street excavation to be done before new paving is put in, thus preventing tearing up new pavements so frequently as is done at present—a practice which could be prevented, no doubt, by a little forethought.

ENGINEERS AND THE PUBLIC.—In an editorial on the influence of the engineer on public affairs—which influence is declared to be practically nil at the present time—*Engineering*, of London, refers with warm approval to the recent action of the American Society of Mechanical Engineers in the appointment of a committee to watch legislation and other public matters, and call the attention of the Council to those which affect the interests of engineers, or in which engineers should intervene for the benefit of the body politic. Reference is made to the effect of the work of the British Standards Committee in showing that there exists a body which can speak with a single voice in the name of engineers, and can impose its opinions upon the units that make up the general body, and the Institute of Civil Engineers is complimented upon its action in making certain recommendations with respect to a building bill before Parliament of importance to engineering construction in the future. While not strictly an engineering body, the National Electric Light Association of this country has recently taken up several matters along the lines of work advocated in the editorial.

ELECTRIC SHOP BOOKLET—Electric Shop is the name given to the display-rooms de lux of the Commonwealth Edison Company, Chicago, which were described and illustrated in a previous issue of *Electrical World*. The company has now issued a handsome booklet, with numerous well-executed pictures, describing the shop and setting forth its purposes. The pamphlet is written with the idea of appealing to women as well as men, and an edition of 50,000 has been printed to be distributed to residence customers of the company. The booklet is a tasteful, high-class production of 34 pages, bearing the embossed crest of Electric Shop in colors on a cover of French gray. To issue a large edition has cost many thousand dollars; but, as in all connected with Electric Shop, the company is planning and executing on a large scale. The idea is to demonstrate the varied uses of electricity in the home. Referring to the use of electrical energy in replacing manual labor in the household, the writer of the booklet says: "It is not to be forgotten that these applications, which many people look upon today as luxuries, will be the everyday necessities of the next generation. Revolutions do not go backward, and labor-saving in the home is just as ineyitable as it was, and is, in the factory."

ANNUAL MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—The thirtieth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, Dec. 7 to 10. The entire social entertainment will be in charge of the members resident in and about New York. For Wednesday afternoon, Dec. 8, an excursion is planned which members and guests will be asked to attend in a body, and during the remainder of the time there will be opportunities for smaller parties to visit places of interest. In the evening, there will be a lecture for members and guests upon the subject of agricultural machinery. The professional papers assigned to the meeting are as follows: "Tests on a Venturi Meter for Boiler Feed," by Mr. Chas. M. Allen; "The Bitot Tube as a Steam Meter," by Mr. Geo. F. Gebhardt; "Efficiency Tests of Steam Nozzles," by Messrs. F. H. Sibley and T. S. Kemble; "An Electric Gas Meter," by Mr. C. C. Thomas; "Tan Bark as a Boiler Fuel," by Mr. David M. Myers; "Cooling Towers for Steam and Gas Power Plants," by Mr. J. R. Bibbins; "Some Studies in Rolling Mill Engines," by Mr. W. P. Caine; "An Experience with Leaky Vertical Fire-Tube Boilers and the Best Form of Longitudinal Joint for Boilers," by Mr. F. W. Dean; "Testing Suction Gas Producers with a Koerting Ejector," by Messrs. C. M. Garland and A. P. Kratz; "Bituminous Gas Producer," by Mr. J. R. Bibbins; "The Bucyrus Locomotive Pile Driver," by Mr. Walter Ferris; "Line-Shaft Efficiency, Mechanical and Economic," by Mr. Henry Hess; "Pump Valves and Valve Areas and a Report on Cast-Iron Test Bars," by Mr. A. F. Nagle. In addition to the above papers there will be several reports submitted by committees of the Gas-Power Section.

Hamburg (Germany) Single-Phase Suburban Traction System.

BY FRANK KOESTER.

DURING the early part of the present year the complete electrification of the Hamburg-Altona & Suburban Railway, between Blankenese and Ohlsdorf, Germany, was accomplished. This railway connects with the twin city Hamburg-Altona, the suburban towns of Blankenese lying in one direction and Ohlsdorf in another direction.

The main passenger station, which lies in the Altona district, serves also as terminal for several steam railroads which were successively entered into this station as a terminal point as follows: The Berlin-Hamburg in 1842, the Altona-Kiel in 1844, the Hamburg-Luebeck in 1865, the Altona-Hamburg connecting link in 1866, the suburban railway Altona-Blankenese in 1867 and the Altona-Hanover Railway in 1872.

Since the latter date extensive reconstruction has taken place and in December, 1906, the main station at Hamburg and the Ohlsdorf branch of this new system were formally opened to the public, so that now all the long-distance railway systems pass through the main station at Hamburg and connect with the terminal station at Altona without crossing any thoroughfares at grade level, while the new Blankenese-Oldsdorf branch has an independent electric system of tracks connecting both main stations at Hamburg and Altona.

The electrification of the Blankenese-Ohlsdorf road has quite a history. The management of the Altona Railway, as far back as 1894, desired to take up the electrification of the Blankenese-Ohlsdorf line, specifying a passenger traffic haulage of 5000 persons per hour in one direction and calling for trains made up of several motor-cars controlled from one point similar to the present electric lines. This condition could not at that time be fulfilled by the manufacturers, as the industry was not sufficiently advanced. After further progress was made and satisfactory experiments were conducted from 1900 to 1902 on the Wannsee Railway, near Berlin, and subsequent to the opening to the public, in 1903, of the Gross-Lichterfelde Railway, and after the successful experiments made with single phase current (Winter-Eichberg system) on the Niederschoeneweide-Spindlersfeld stretch in the summer of 1903, the electrification of the Blankenese-Ohlsdorf Railway for single-phase current was ordered. In the meantime, however, in October, 1902, steps had been taken looking toward the electrification of the road with a direct-current system, only to give way finally, as stated, to the more suitable single-phase system, the trolley e.m.f. being 6000 volts, 25 cycles, decreased to 450 volts or 720 volts for the motors.

The generating plant is located near the river bank not far from the Altona terminal station. The location of the plant was optional, as high tension was used for the transmission of energy, and while the railroad afforded cheaper transportation of coal than could be had by water the locality near the river was chosen principally for condenser water supply.

The boiler-room is parallel to and adjoins the generator room; adjoining the end of the boiler-room the economizer and pump-room are located, beyond which are the two smokestacks, and four prominent cooling towers, as seen in Fig. 1, which shows the generator side of the building with a switch-room annex and tower in the foreground. The coal and ash-handling system is shown in the background to the right.

Coal is brought in on tracks on an embankment, dumped from the cars either into the coal-storage yards or into the bins from which it is fed by means of a distributing conveyor into the buckets of an elevator and then carried by means of a horizontal conveyor into suspended coal bunkers over the firing aisle of the boiler-room. The coal from the storage yard is also delivered to three bunkers in the boiler-room by the same manipulation, while, in reverse order and by the same machinery, the ashes are delivered to a bin above the tracks and dumped into the cars.

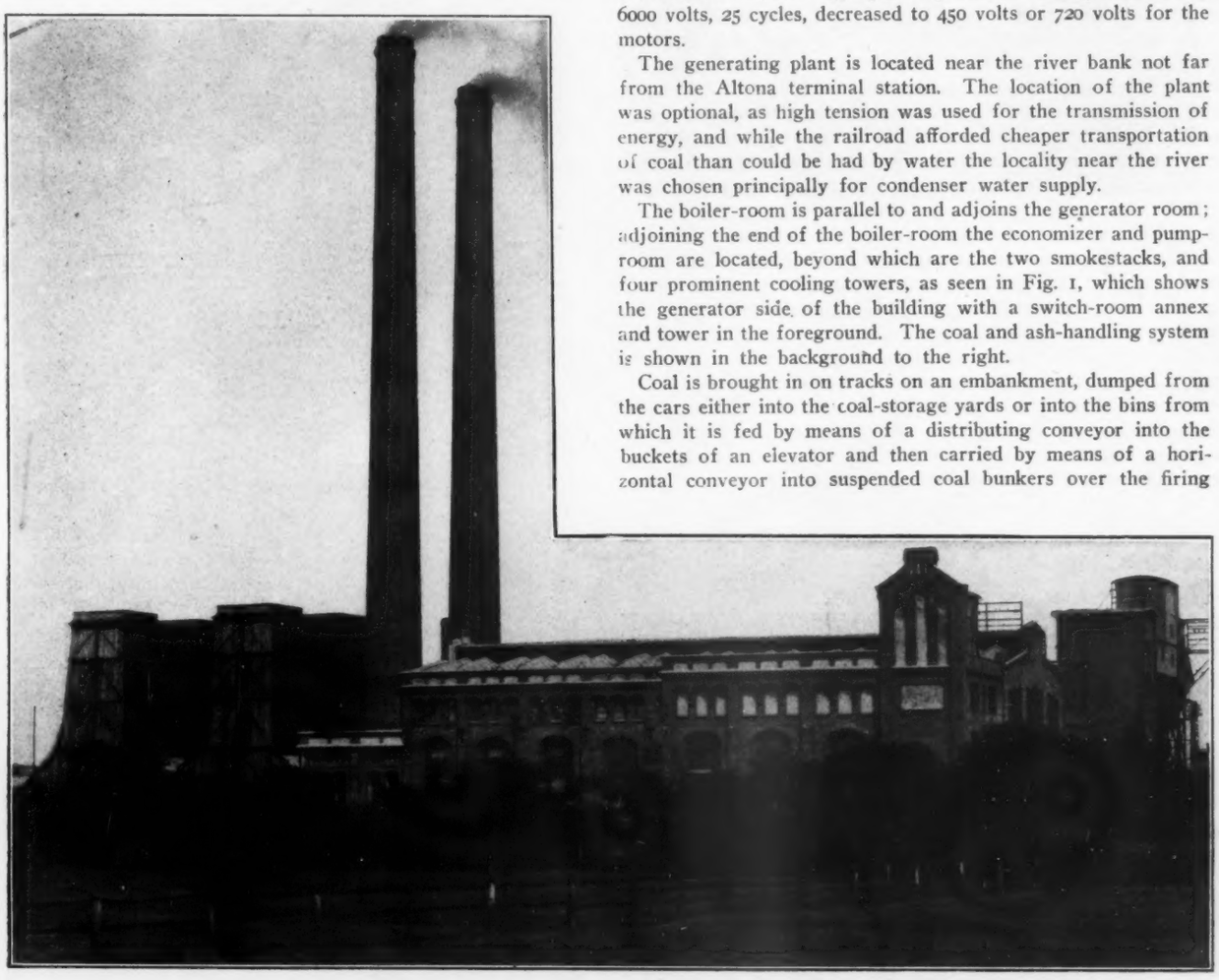


FIG. 1.—GENERAL VIEW OF GENERATING STATION SHOWING COOLING TOWERS AND SWITCH-ROOM ANNEX.

The boilers are arranged in two rows, two in a battery, with a firing aisle between the two rows of boilers. At present there are installed nine Borsig water-tube boilers, each with a heating surface of 3220 sq. ft. Superheaters are located between the nest of tubes and the drums. Steam at 225-lb. pressure and a total temperature of 660 deg. Fahr. is used. The guaranteed efficiency of the boilers is 72 per cent, and they are capable of evaporating between 4 lb. and 6 lb. of water per hour per square foot of heating surface. The amount of superheat is regulated

by means of a damper by deflecting a part of the gases to by-pass the superheater.

The gases from each row of boilers before entering the chimney are conveyed through flues under the boiler-room floor to an economizer for each row, each economizer having 6420 sq. ft. of heating surface. The chimneys, which are of radial brick, have a diameter at the top of 8.8 ft. and are 233 ft. high.

Four main turbo-generators are installed at present, of 1250

FIG. 2.—SWITCHING-ROOM OF ALTONA POWER HOUSE.

kw each. They are equipped with surface condensers which are located in the basement between the turbo-generator foundations. The cooling water is supplied by motor-driven centrifugal pumps; the water of condensation is pumped into the cooling towers by means of wet vacuum pumps. This water, together with that to supply the loss, is pumped back into the boilers through the economizers.

The main generators for railway service are designed for a normal rating of 1250 kw, with a power factor of 0.75 and a 36 per cent overload range. They are two-pole, 6000-volt, 25-cycle machines.

The excitation of each main generator is accomplished by what is known as the Danielson system, one main and one

FIG. 3.—BOILER-ROOM AT ALTONA POWER HOUSE.

auxiliary exciter being mounted on a smaller shaft, which is coupled to the end of, and forms an extension to, the shaft of the main generator, as may be seen from Fig. 6. The field of such main generator is excited by the main exciter, which operates by current from the auxiliary exciter, which is a single-armature converter, whose fields are excited by current from a storage battery and having on one side a commutator and on the other side collector rings which receive alternating current through step-down transformers from the main generator. The alternating current produces an auxiliary field so that the voltage at the commutator is regulated according to the needs of the line and influences the main exciter and consequently the main railway generators, each of which has its own

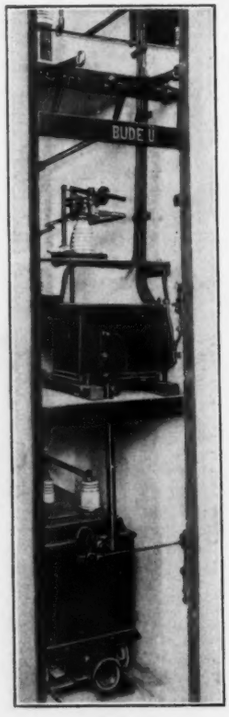


FIG. 4.—30,000-VOLT OIL CIRCUIT-BREAKERS.

transformer, these being interconnected and thus equalizing the work performed by the generators.

While the railway generator sets were guaranteed not to fluctuate more than 12 per cent with a load from zero to 1500 kw, with a power factor of 0.75, it was found in actual operation that with the above fluctuation in load and a power factor of 0.8, the fluctuation in voltages was even less than 4 per cent. Such close regulation in excitation is, however, not adhered to, as it is not necessary under ordinary operating conditions.

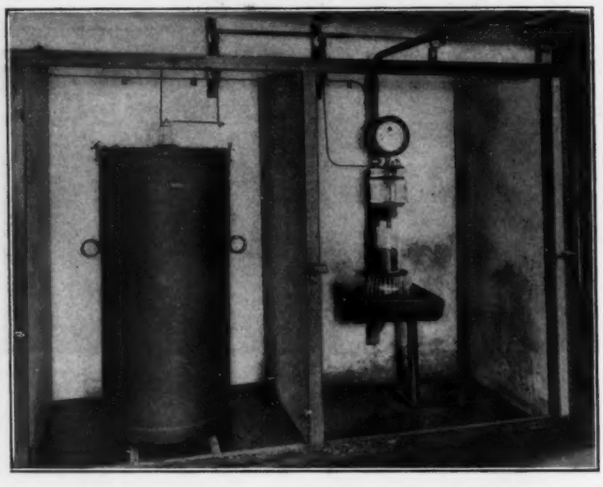


FIG. 5.—OIL RHEOSTAT AND WATER-FLOW GROUNDER.

There is also installed a 600-kw turbo-generator set for lighting purposes, and in connection with it there are two rotary converter sets working in parallel with the generator and which also may supply current to the various motors in the plant. These rotary sets are of different ratings, the large unit consist-

ing of three machines mounted on one shaft, namely, one 25-cycle, 600-kw alternator with one 50-cycle, 600-kw alternator, and one 250-kw, 220-volt, direct-current machine. The small converter unit also consists of three machines similarly mounted on one shaft, namely, one 250-kw, 25-cycle alternator; one 150-kw, 50-cycle alternator, and one 250-kw, 220-volt, direct-current machine.

A booster is also installed in connection with a 110-volt, 814-amp-hour storage battery.

It was considered expedient, for the purpose of supplying energy to the motor-driven auxiliaries, such as boiler-feed and condenser pumps, coal and ash-handling machinery, etc., to install an independent 350-kw turbo-generator set, this being a direct-current generator.

The switchroom is adjacent to the generating room and its switchboard gallery overlooks the latter. The cables from the generator room lead through a well lighted passage to the bus-bars. The main oil switches are of the remote-control, motor-operated type, provided with time-limit relays.

The e.m.f. from the generators is stepped up from 6000 volts to 30,000 volts by means of oil-cooled, water-circulated transformers for transmission along the line. The outgoing lines are protected against lightning by means of horn-gaps and water-flow grounders, while the generators are protected by horn-gap oil rheostats and choke coils.

In some cases the old signal towers could be utilized for transformer stations, while at some distributing points, as at Barmbek, new substations were erected. The Barmbek station had two 650-kva water-cooled transformers, for which a continuously operating pump had to be installed. Other transformers are installed at the stations and car barns, at which points only low-tension voltage is used.

The feeder lines to the trolley wire, as a general rule, are carried on the same poles as the latter. The high-tension trolley line in the open (6000-volt) is suspended 17 ft. above the rails, while the lowest point, under bridges, is 15.75 ft. The low-tension trolley line (300-volt) is 14.75 ft. above the rails, and is placed off the center of the track from 2 ft. to 3 ft. In order that the contact bow may wear uniformly the trolley wire runs in a serpentine or wave-like path, so that it extends on both sides of the center line of the track, the extreme dimensions from this center line being 20 in., and the wave-length 450 ft.

The overhead construction is made up of a catenary, a contact wire and an auxiliary wire between the two. The standard arrangement supporting the contact wire is supported from the auxiliary wire at intervals of 10 ft. by means of short loops, while the hangers between the catenary and auxiliary wires are 19.6 ft. apart. With this arrangement double insulation is provided. The double insulation, furthermore, permits each insulator to be tested in service at higher voltages than the operating one. Another advantage of the system is that in case of a break in the contact wire the ends of the broken section cannot fall low enough to make any dangerous contact.

The standard spacing of the main catenary is 131 ft. and in erecting it a sag of 4.92 ft. is allowed. This deep sag is purposely made so that expansion and contraction will have very little influence, and proper contact is obtained under varying conditions of weather.

The supporting of the main catenary is accomplished either by cross-wires in the open or by bridges or cross-arms in sta-

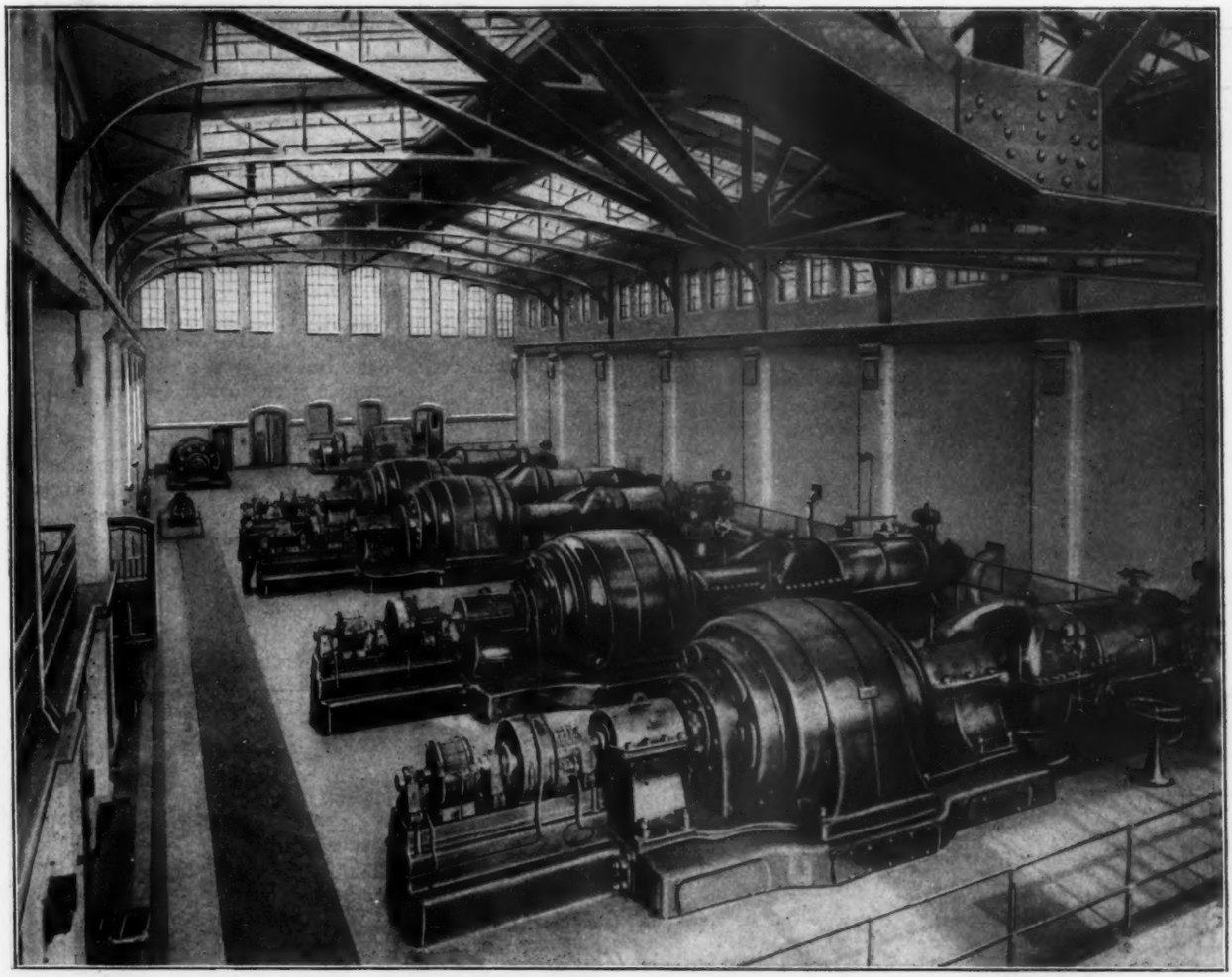


FIG. 6.—INTERIOR OF ALTONA GENERATING STATION.

tions or yards. In the last two cases the catenary is supported on a strap-iron stilt which can be shifted on the cross-arms or bridges as desired. The catenaries are made up of short stretches and are attached to the cast-iron caps of the insulators carried on these stilts

The expansion, or stretch, of the auxiliary wire and conductor is taken up by a special automatic tension device located at intervals of from 2600 ft. to 4200 ft. At these points the ends of both auxiliary as well as contact wires, all of which are made in sections, overlap each other for this purpose. The stretch is taken up for each section by a weight connected to each overlapping end by chains running over sheaves arranged by the side of the poles, the weight being 180 lb. As these wires are made in sections, three points serve simultaneously for the installation of section-breakers.

The standard poles are composed of two channel irons with lattice bracing, and are usually set in concrete about 6 ft. deep and are grounded to the rails by copper wire. Some of the poles, as those at the Lombard Bridge, are of special, artistic design, and the feeders are arranged on an extension of the pole, above the arms. At crossings or at other dangerous points are arranged guard wires upon which the ends of broken wires may be caught up.

At some of the stations which, as stated, are used in common for the steam railroad trunk lines and the electric system, the catenaries are made of silicon-bronze to preserve them from the destructive action of the smoke of the locomotives.

For inspection and testing of the lines two special tool cars are held in readiness. Each is equipped with a 160-cell, 183-amp-hour storage battery, and two 15-hp motors, able to give a speed on a straight stretch of 11.5 miles per hour. The car is similar to a box freight car, and is surmounted with a swiveling gallery, while at each end of the car is a grounded contact bow for the protection of the workman on the gallery.

The repair shops are located at the north end of the Ohlsdorf station. The car barn is arranged for 30 motor-cars, and is to be enlarged so as to accommodate a total of 48 motor-cars under repair.

A notable feature of the repair barns is the jacks in use for raising the body of the car for the purpose of removing the trucks. Such a procedure occupies less than five minutes. The screw spindles of the jacks are motor-operated. The jacks consist of four uprights, two on each side of the track, which are

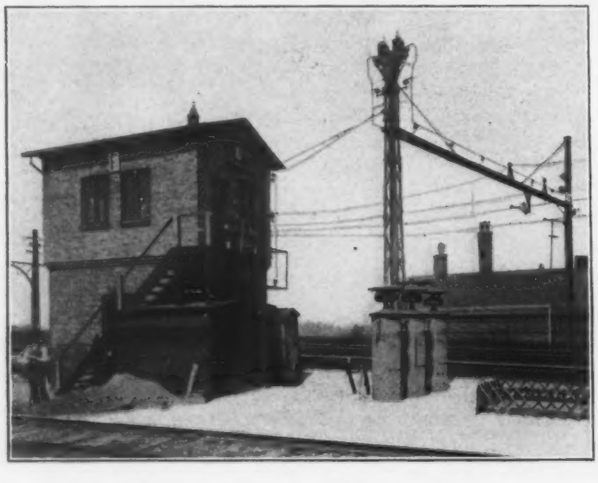


FIG. 7.—SUBSTATION AND RAILWAY FEEDER POINT.

mounted on a sub-base on the side of the tracks in such manner that the jacks may be shifted to positions which will accommodate different designs of cars. The maximum lift is 3 ft.

Other buildings consist of assembly-rooms for the employees, foundry, wheel shops, machine shops and others necessary for an up-to-date and well-equipped electric traction system.

The original rolling stock consists of 60 motor-cars of the so- called twin-car type, being a double-body, close-coupled car having no platforms between the two bodies; in accordance with German railway practice, these are coupé cars with side-door entrances and a side corridor extending the full length of each body of the twin car. Each body is divided into second-class and third-class coupés, the corridor communication being closed off between. The single body is about 46 ft. long, the space between bodies being about 14 in., so that the total length of the car is about 93 ft., not including the buffers between cars, for

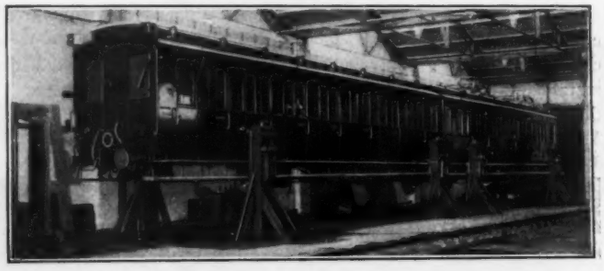


FIG. 8.—MOTOR-OPERATED CAR JACK.

which 4 ft. must be added. The car body is 8.5 ft. wide, while the width across the steps is 10.3 ft. The top of the car stands 13 ft. above the rails.

These cars are of two different makes, 54 cars having been supplied by the Allgemeine Elektricitäts Gesellschaft and six by the Siemens-Schuckert Werke. These makes are alike in their principal features.

To provide economical operation and in order to compete successfully with the regular street railways, a twin car is so designed as to be a unit within itself to serve during non-rush hours. Therefore, a twin car is provided with two motorman's cabins so arranged that the one not in use may be used as a third-class compartment. Some of the third-class compartments have folding seats so that they may serve for carrying baggage. The seating accommodation of such twin cars is 120 passengers.

Fifty of these cars are so divided as to have five second-class, eight third-class and one baggage compartment, together with two motorman's cabins, while 10 of these cars have only third-class compartments and those for baggage and motorman.

The longest trains used at present consist of three twin cars, but arrangements are now being made for four-car trains. Each

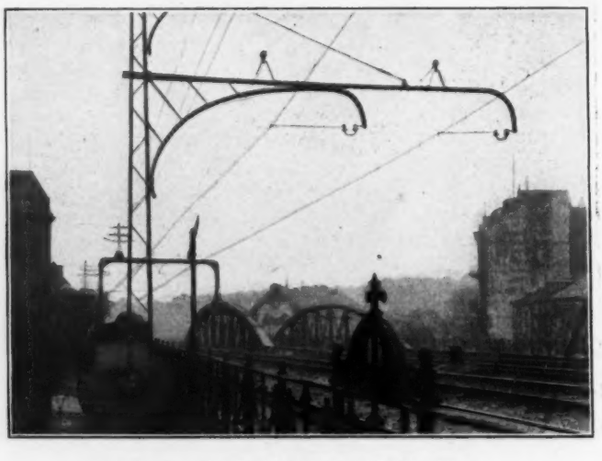


FIG. 9.—CATENARY LINE INSTALLATION.

body of a twin car is provided with a four-wheel truck at its outer end and a single axle at the end adjoining its twin body.

The cars furnished by the Allgemeine Elektricitäts Gesellschaft are equipped with three 115-hp motors of the Winter-Eichberg type, two of which are mounted on the four-wheel truck and one on the two-wheel end, being geared to the axles in the ratio of 1:422. The wheels are 1 m (3.28 ft.) in diameter and the schedule speed is 30 miles per hour. It might be added

here that the experimental car was originally equipped with two 200-hp motors.

The cars are normally operated at 6000 volts, but at the stations and at car barns the trolley potential is only 500 volts. The high-tension current is collected by two bows at one end of the twin-body cars, which bows are raised and lowered by compressed-air mechanism, while the low-tension current is collected by a wheel collector, the highest attainable position of which is such that it at no time can reach the high-tension wire. The bows are provided with interchangeable aluminum strips 4.25 ft. long.

The 6000-volt current of the trolley passes successively from the collector bow through a switch, lightning arrester, choke coil, fuse and an automatic oil circuit-breaker, and then to the transformer from the low-tension side of which current may be drawn at 300 volts, 450 volts and 720 volts.

The motors are of the compensated-series type and rated at 200 hp for one-hour duration when making 500 r.p.m. and 100 hp for continuous operation. The stator winding consists of main and interpole coils connected in series. The interpole winding is connected to taps of the exciter transformer, which influences it so as to deliver a practically correct cross-field to counterbalance the transformer e.m.f. The interpoles simultaneously give a component field for taking up the commutation voltage, as in a direct-current motor. This design of motor permits unusually large air-gaps without loss of efficiency. Each of the six main poles of the stator winding has three coils, there being three communicating poles. The windings of the armature are of the normal direct-current form. A centrifugal ventilator at the side of the armature forces air through the armature and commutator, but air is not permitted to come in contact with the current-carrying parts.

The Siemens-Schuckert cars are equipped with two 150-hp motors geared to the shaft in the ratio of 1:3.65. The electrical equipment of these cars weighs 15.5 metric tons, while that of the Allgemeine Elektricitäts Gesellschaft weighs 17 metric tons, the total weight of the former car being 69.5 metric tons and of the latter 71 metric tons.

The 300-volt auxiliary circuit supplies energy for lighting and heating the cars and for operating the air compressor; electrical air brakes are not used, although provision is made for them. The heaters are cut in only when the motor current is cut out, and are controlled from the motorman's cabin. However, the heat in each individual car may be controlled by a switch provided for this purpose. Each coupé is provided with two heaters, one of 2 kw and the other of 1 kw, thus providing three stages for heat, viz., 1 kw, 2 kw and 3 kw, while the motorman's cabin has a heater of 2 kw. When all heaters are cut in and with 6000 volts on the trolley, the heaters consume 43 kw.

There are two distinct lighting circuits, one for signals and one for lighting the cars.

For operating on low-tension (300 volts), the high-tension or bow collectors are lowered and the low-tension wheel collectors are raised by means of a voltage-changer, which consists of two magnetic coils, one of which is connected to the 300-volt coil of the main transformer and the other to the low-tension trolley line. The action of these coils is such as to lower one collector when the other is raised.

During light-traffic hours, as stated, the line is operated with single twin cars, while at other times trains are made up of two or three twin cars. The minimum schedule headway is four minutes, while the average daily run of a car is 279 miles and the average total per day (working days) is 432 trains. The average week-day train would consist of 1½ cars.

Since the electrification was completed, traffic has steadily increased so that it was found necessary to increase the original equipment by 42 cars, which were ordered in part from each of the two companies named.

The principal contractors for the entire equipment, power house, transmission, substations, overhead construction, motor-cars, etc., were the Siemens-Schuckert Werke, the Allgemeine Elektricitäts Gesellschaft, Brown, Boveri & Company and Felten & Guilleaume-Lahmeyer Works.

Frequency Relay.

The frequency relay shown by the diagram herewith is based upon the principle of "resonance," so-called. It operates when the fluxes in its two separate magnetic cores are in time-quadrature and are of sufficient strength. In series with one of the exciting coils is placed a condenser, the capacity of which is so adjusted that its condensive reactance is equal to the inductive reactance of the exciting coil at the chosen frequency; hence, the current in this circuit depends only on the resistance and is in time-phase with the impressed e.m.f. In the other exciting circuit the current is in time-quadrature with the e.m.f., so that the phase relations and current strengths are correct for operation at the chosen frequency. At any other frequency the current in the condenser circuit is much decreased in value and shifted in time-phase, so that the relay is unable to operate. This relay, which was patented on July 20 by Mr. D. J. McCarthy, is intended for use with block signal systems on electric railways employing either direct or alternating current.

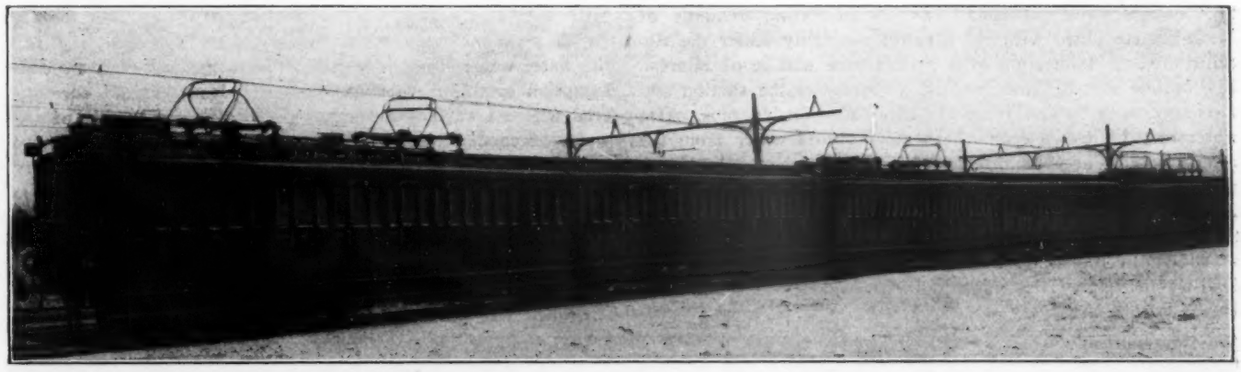
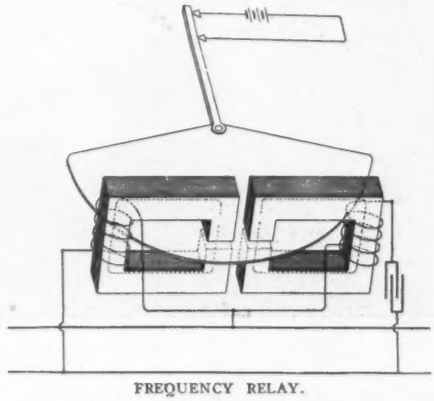


FIG. 10.—TRAIN ON HAMBURG SINGLE-PHASE ROAD.



FREQUENCY RELAY.

Tests of a Small Steam-Turbine Plant.

By George W. Martin.

IN the issue of the *Electrical World* of Feb. 29, 1908, details were given of a combined water-works and electric plant to be erected at Pine Bluff, Ark., by Ford, Bacon & Davis, for the Equitable Securities Company, of New York. With the recent completion of the plant, data of tests of the boiler and steam-turbine equipment are now available and are here given as being of possible interest to construction and operating engineers.

Before taking up the details of the tests, it will be of interest to discuss certain points which were brought out in the preliminary runs made before the final tests. The condensing equipment for the turbines consists of two sets of Alberger "centrifugal" barometric jet condensers. Each condenser is provided with a dry-vacuum pump and a centrifugal pump, the latter being located on the discharge side of the condenser. Two cooling towers, each with a fan driven by a 12-hp induction motor, are provided to cool the condensing water.

It is obvious that with this arrangement of condensing apparatus the steam consumption of the turbine could not be ascertained by weighing the water of condensation. The only other means of arriving at the desired result was by weighing the water fed to the boiler. Owing to the excellent design of the main steam header and the flexible arrangement of steam and feed-water piping this was easily accomplished. As the design of the feed-water piping affords an interesting example of flexibility combined with the greatest simplicity under the circumstances, a description of it at this time will be of interest. The outline sketch shown in Fig. 3 represents the suction and discharge lines to and from the two boiler-feed pumps. Hot water may be drawn from the heater or cold water from the reservoir, and may be discharged through either a line running over the boilers or a line running in a trench in front of the ash-pit doors. From these lines connections are made to the drum in the rear of each boiler, as shown in Fig. 4. Any one of the boilers may take its feed-water supply from either of these lines. It is an easy matter, then, to take hot water from one source and discharge it over one line, and take cold water from the reservoir by means of the second pump and discharge it through the other discharge line. The practice followed during the tests was to feed the cold water through the lower supply line and discharge the hot water from the heater through the overhead feed-supply line.

The water fed to the boiler was weighed in a barrel placed on platform scales, the water after weighing being allowed to run into a tank 5 ft. in diameter by 4 ft. deep. The lower suction line of one of the feed pumps was interrupted at the T shown at the left in Fig. 3, and a connection was made from the tank to this point. The discharge from a relief valve in the discharge line from this pump was piped back to the tank, so that none of the water weighed might be lost. The measuring of steam consumption by this method has some disadvantages not encountered where a surface condenser permits the measuring of the water of condensation. In the first place, special care must be exercised in regulating the supply to the boiler, as the cold water expands considerably on heating, and if the firemen let too much water in the boiler the expansion of the water will fill the boiler and necessitate blowing down. If this happens during the test it is obvious that the results will be valueless. Care must also be exercised to prevent any popping of the safety valve due to excess pressure, resulting in loss of steam. When the boiler only is being tested, the safety valve may be allowed to pop at will, as the evaporation is ascertained by weighing the water fed to the boiler.

Between the weighing tank and the boilers there is also a possibility of loss by leakage. As already mentioned, one source of loss would be from the overflow or discharge of an automatic relief valve in the feed-water discharge line. With

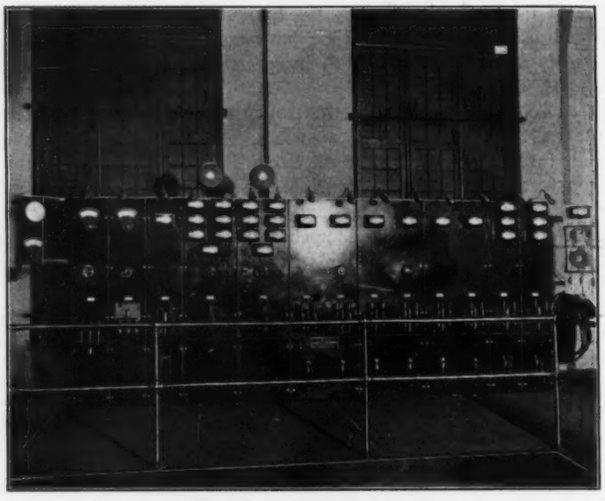


FIG. 2.—SWITCHBOARD.

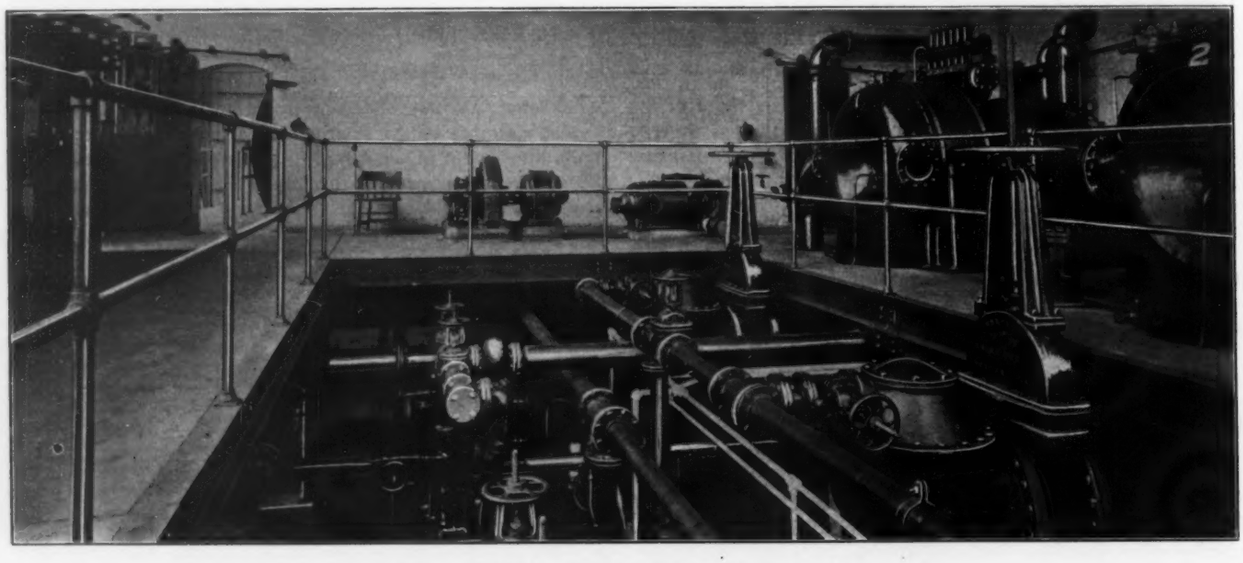


FIG. 1.—GENERAL VIEW OF GENERATING STATION.

outside-packed plunger pumps—as installed in the present instance—the change from hot to cold water will necessitate tightening up the packing. This can readily be accomplished if the proper kind of packing is used. It was found that the comparatively inelastic canvas packing was unsuitable for this

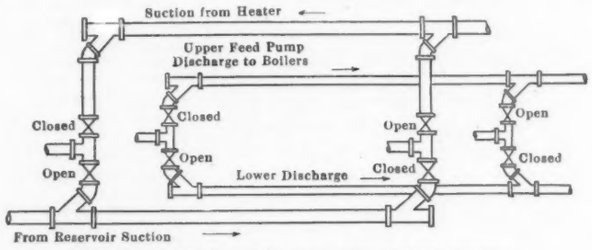


FIG. 3.—ARRANGEMENT FOR FEED-WATER PIPING.

work, the material finally selected being a combination as shown in Fig. 5.

The weight of the plunger in outside-packed plunger pumps appears to wear the packing thinner on the bottom side. When it is desired to take up on the packing, the latter must have an elastic quality, as otherwise equal compression on the thicker top part and the thinner bottom part will cause the plunger to bind if the packing is compressed enough to prevent leaks at the bottom. The necessary elastic quality is largely obtained in the packing illustrated by means of the triangular sections sliding on their hypothenuse.

Another disadvantage of this method of measuring steam consumption is the difficulty of determining the exact amount of steam used by the turbine during each hour. Although during the test the water in the boiler was brought to the same height in the gage glass at the end of each hour, the expansion of the cold water, after entering the boiler, offered an opportunity for error. Moreover, a difference of a small fraction of an inch in the level would make an appreciable difference in the amount of water fed to the boiler. If it had been possible to run the feed pump at constant speed and maintain a continuous supply to the boiler, the results would have agreed more closely. As it was, however, in some cases with a greater load the consumption per kw-hour increased, and decreased on lighter load, while, on the other hand, the consumption decreased in some cases with greater load and increased with lighter load, as was to be expected. This fact necessitated making a curve of average consumption by means of a gun-shot diagram. Open to criticism as these curves may be, their close agreement with the manufacturer's guarantee proves their accuracy in a sufficient degree.

It will be noticed that the turbine tests were made with the all-day commercial load on the unit instead of running with a

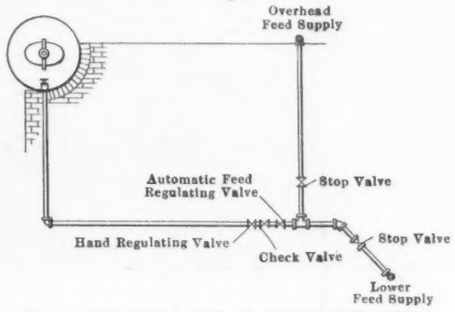


FIG. 4.—ARRANGEMENT OF BOILER-FEED PIPING.

steady load at one-half, full or 1½ rated load. When arrangements were made for these tests it was found that the unit in reserve needed some adjustments which would take some few days. As the other unit was in regular service it was, therefore, necessary to use the regular commercial load. As the greatest load at the time of the test reached only 250 kw, a short run was made later at full load using a water rheostat to obtain points farther along the curve.

BOILER EFFICIENCY AND OUTPUT TESTS.

The boiler installation consists of four 300-hp Babcock & Wilcox units set in two batteries of two boilers each. Each boiler contains 2979 sq. ft. of heating surface consisting of 140 4-in. tubes arranged in 14 sections, each section being 10

FIG. 5.—PACKING FOR OUTSIDE-PACKED PLUNGERS ON FEED PUMPS.

tubes high; and one steam and water drum 54 in. in diameter and 9½ ft. long placed across the setting at the rear. The boilers are designed for a working pressure of 200 lb. per square inch, but are now operated at 150 lb. Each boiler is fitted with "Ajax" shaking grates, 59.6 sq. ft. in area.

The guarantee called for an efficiency of 57.5 per cent when the boilers are fired with bituminous coal containing not less than 12,000 lb.-Fahr. units per pound of dry coal, and an efficiency of 67.5 per cent when fired with bituminous coal containing not less than 14,000 lb.-Fahr. units per pound of dry coal.

The output guarantee called for an evaporation of not less than 15,700 lb. of water per hour from and at 212 deg. Fahr. with coal containing not less than 13,500 lb.-Fahr. units per pound. During both efficiency and output tests, however, the same coal was used—Arkansas slack averaging slightly over 12,000 lb.-Fahr. units per pound of dry coal.

The guarantee of moisture in the steam was to the effect that when a boiler was operated within 10 per cent of normal rating (300 hp) the steam should not contain more than 1 per cent of moisture, as measured by calorimeter at the boiler outlet, and when evaporating 15,700 lb. of water per hour from and at 212 deg. Fahr., the steam should not contain over 2 per cent moisture. Taking 34.5 lb. per hour evaporation from and at 212 deg. Fahr. as a boiler horse-power, the rate of 15,700 lb. per hour would give an output of 450 hp, or 50 per cent above rating. It was not possible to reach this output on test, however, owing to the fact that coal of 13,500 lb.Fahr. units was not available.

The firing during the tests was done by one of the operating firemen under the direction and with the assistance of a representative of the boiler contractors. The coal was weighed in wheelbarrows and dumped on the firing floor in front of the boiler.

The layer of coal during the efficiency test varied from 12 in. to 14 in. in thickness. The fire was not cleaned during the test, the grates being shaken from time to time to work the ash through. After the test was completed the fire was cleaned to determine the amount of clinkers on the grate. A large portion of the grate was found to be covered with a clinker from 3 in. to 5 in. thick, but of a porous nature, so that apparently the draft was not materially diminished; in fact, the draft during the latter half of the test remained practically constant, while the output during the last hour was greater than that during the two hours preceding. During the third hour of the test the damper was closed further to keep the boiler from running too much above rating and remained this way until the end of the test.

For the output test the coal used was the coarsest of the slack used for the efficiency test. The fire was carried about 10 in. thick. Early in the test a hard clinker formed on the grates, so that they could not be shaken. A steam jet was, therefore, turned into the ash pit, resulting in softening the clinker so that the grates could be shaken. From time to time during the test a few clinkers were taken out, and at the end the fires were cleaned. The steam jet softened the clinkers so that almost all the ash could be worked through the grate.

Previous to the final output test a preliminary test was made, using MacAlester gas coal, a selected lump bituminous variety, containing about 14,000 lb.-Fahr. units and only 5 per cent ash. This ash formed a thin but dense clinker on the

grate, which stopped the flow of air, and could not be removed until the clinker had cooled. The first hour of this preliminary test showed an output of 50 per cent above rating, but at the end of the third hour the output had dropped below rating.

DATA OF EFFICIENCY AND OUTPUT TESTS.

	Efficiency	Output
Make of boiler tested	Babcock & Wilcox	B. & W.
Grate	Ajax Shaking	Ajax
Boiler output, hp.	297.9	297.9
Grate area, sq. ft.	59.5	59.5
Water heating surface, sq. ft.	2,979	2,979
Ratio grate to heating surface	1:50	1:50
Duration of test, hours	8	6
Kind of coal	Arkansas Slack.	

AVERAGE PRESSURES.

Steam (Gage) lb. per sq. in.	149.2	150
Steam (Absolute), lb. per sq. in.	163.9	164.7
Draft (In Furnace), in. water	.35	.39
" (Middle Pass)	.42	.47
" (Rear Pass)	.47	.54
" (In Breeching)	.59	.58
" (In Stack)	.60	.60

AVERAGE TEMPERATURES, DEG. FAHR.

Boiler Room	63	73
Flue Gases in Uptake	533.6	633
Feed Water	71	73
Steam	365.5	365.6
Calorimeter	293.56	300.7

FUEL DATA.

	Efficiency	Output
Total weight of coal as fired, lb.	10,500	8,850
Surface moisture in coal, per cent.	3	3
Total dry fuel consumed, lb.	10,185	8,584.5
Total ash and refuse, lb.	1,575	1,314
Per cent of ash and refuse in dry coal	15.5	15.3
Total combustible consumed, lb.	8,610	7,270.5
Dry coal per sq. ft. grate per hour, lb.	21.4	24.0
" " " hp per hour, lb.	3.96	3.76

WATER.

Total weight of water fed to boiler, lb.	74,712	66,332
Moisture in Steam, per cent.	0.88	0.54
Water Evaporated, lb.	74,055	65,974
Factor of Evaporation	1.1953	1.1934
Equivalent Water from and at 212° F., lb.	88,518	78,733
" " per hour " " " "	11,065	13,122

EVAPORATION PER LB. OF FUEL.

Water Evaporated per lb. of coal as fired	7.11	7.43
" " " " dry coal	7.27	7.68
" " from and at 212° per 16. dry coal	8.69	9.17
" " " " per 16. comb'st'ble	10.28	10.83

HORSE-POWER.

Horse-Power Developed, A. S. M. E. rating	320.7	380.3
Percentage of rating developed	107.7	127.7

EFFICIENCY.

Lb.-Fahr. units per lb. dry coal (approximate)	12,000
Efficiency of boiler and grate, per cent.	69.9

COST OF EVAPORATION.

Cost of coal per ton (2,000 lb.) at power house	$2.50
Cost of dry coal per hp-hour	0.00495

COAL CONSUMPTION TESTS.

While on the subject of boiler tests it may be of interest to describe briefly the measures taken to cut down the amount of fuel consumed. All the coal was weighed for 72 hours, divided into three periods of 24 hours each. No special attempt was made at damper regulation. The test was started immediately after cleaning fires.

As the load on the water-works end of the plant is practically constant from day to day, the electric load is specified in the following table to show any possible variation in the total load during each period:

	Kw-hours	Lbs. Coal	Surface Moisture	Lbs. Dry Coal
1st Period	2,530	36,409	7%	33,861
2nd "	2,410	43,500	7%	40,325
3rd "	2,420	36,000	3%	34,920

Note: The large percentage of surface moisture during the first two periods was due to rain.

In looking for the cause of the increased consumption during the second period it was found that the damper on one of the boilers had been left almost wide open after cleaning fires at the beginning of the period. The damper was readjusted with the result as shown.

Some weeks later other tests were made to see if the dampers could not be adjusted to give more economical results. It had been the practice of the firemen to carry a heavy fire with the damper more than half open, except that when cleaning the fires the dampers were opened wide and later closed to the former position when the fires had been again built up.

The plan adopted to find the best position of the damper was to close the damper by steps until a point was reached where the steam pressure could not be held up. The damper was then opened just enough to carry the pressure easily and the position of the damper rod was marked on the brickwork. When cleaning fires it was found advisable to open the damper a greater amount, and afterward bring it back to its former position.

It had also been noticed that the fire was not raked over

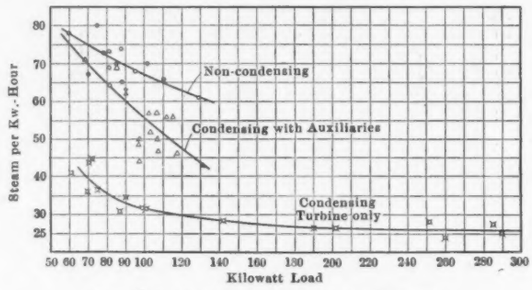


FIG. 6.—LOAD TEST OF STEAM TURBINE.

except at long intervals, the practice being to break up the fire by slicing it when it became too thick. The change adopted was to rake over the fire a few minutes after fresh coal had been thrown on, breaking up the caked coal and enabling it to burn freely. On light load it was found that a light fire, about 4 in. thick, could be carried, raking over the fire after each fresh supply of coal. On heavy load a thicker fire, about 8 in., was necessary, the damper being opened a little more and the coal raked over after two or three fresh firings.

With this method of firing the change in the amount of clinkers was very noticeable. On cleaning the fires on light load during the first 24 hours hardly any clinker was found. On heavy load the amount of clinker decreased considerably. During the second 24 hours, when cleaning fires on heavy load, one fire showed little clinker and the other less as compared with former instances.

The results obtained on this test were as follows:

	Load on Turbine kw-hours	Coal Consumed lb.
1st Period	2,160	33,250
2nd Period	2,340	31,750

The reduction in the amount of clinker should prolong the life of the grates. With the old method of firing, also, it was necessary at times to make a battering ram of the slice bar to break up the clinkers.

It was observed that not once during the test did the safety

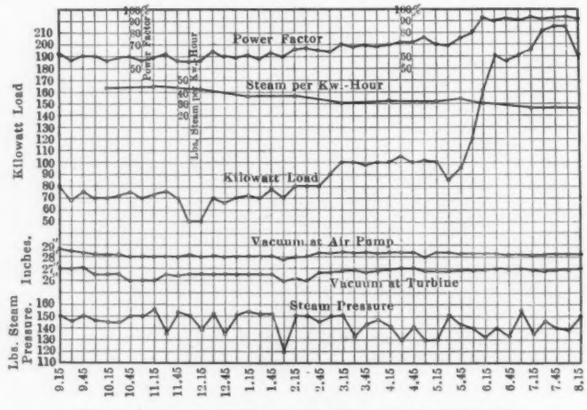


FIG. 7.—LOG OF TEST OF 300-KW STEAM TURBINE.

valve open, resulting in a saving in steam generated. The nicety of adjustment of the dampers was evidenced by the fact that when a hissing at the safety valves warned the fireman, closing the ash-pit doors for a few seconds brought the steam down enough to prevent popping off.

STEAM TURBINES AND GENERATORS.

The turbine installation consists of two 300-kw Curtis hori-

zontal units directly connected to 2300-volt, 60-cycle, three-phase alternators running at 1800 r.p.m. A 20-kw turbine-driven exciter set held in reserve has a rating of 160 amp, volts at no-load being 115 and 125 at full-load, the speed being 4500 r.p.m. For normal use exciting current is supplied by a motor-generator set running at 1200 r.p.m. The motor is a 30-hp, three-phase, 60-cycle machine.

The guarantee specifies that with 150 lb. gage pressure and 27 in. vacuum, the alternating-current generator shall be capable of delivering 75 amp per terminal at 60 cycles and 2300 volts and unity power factor, the exciting current being 65 amp at 90 volts. With a vacuum of 26 in. the unit is guaranteed to deliver continuously 500 kw with a temperature rise not exceeding 50 deg. C., and to deliver momentarily 600 kw. The exciters are guaranteed to furnish current for excitation when the alternators are operating under all variations of load from no-load at 2080 volts to 150 per cent of rated load at 2300 volts and 90 per cent power factor.

The guarantee as to steam consumption requires that the steam consumption per kw-hour, when operating at 150 lb. steam pressure, with saturated steam, shall not exceed the following:

	Kw.	Vacuum, in.	Lbs. steam per kw-hour
One-half load	150	27	29.0
Rated load	300	27	25.3
One and one-half load	450	26	26.0

Should the average steam pressure vary from 150 lb., as specified, the steam consumption per kw-hour shall be corrected in the proportion of 1 per cent for every 6.7 lb. variation from 150 lb. between the limits of 135 lb. and 175 lb., the correction being added to the pounds per kw-hour obtained on test if the pressure averages over 150 lb. Should the average vacuum vary from 27 in. or 26 in., as specified, the steam consumption per kw-hour obtained on test shall be corrected in the proportion of 1¾ lb. for every inch variation from 27 in. or 26 in., the correction being added if the vacuum averages over 27 in. or 26 in. and deducted if the vacuum averages under 27 in. or 26 in. This correction applies only to a vacuum over 25 in.

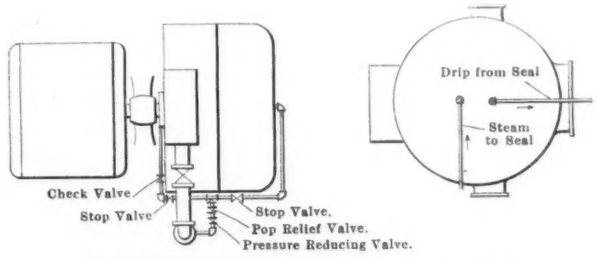


FIG. 8.—ARRANGEMENT OF CARBON-SEAL PIPING.

Should the steam contain moisture the steam consumption should be corrected by a 2 per cent increase for each 1 per cent of moisture in the steam. All the guarantees of steam consumption given in the foregoing include all the steam used by the turbine and all the leakages and losses of steam in the turbine.

During the turbine guarantee test the main steam header was sectionalized so that the turbine was operated from one boiler. The feed water was weighed before entering the boiler and the water in the gage glass was brought to a marked point at the start of the test. On the all-day test the water was brought to this point at the end of each hour, and on the full-load test at the end of each half hour. Thus the tests were divided into hourly and half-hourly periods and the steam per kw-hour was calculated for these periods.

All drips from the steam header and the separator on the turbine steam line were discharged into barrels, the amount being deducted from the total amount of water fed to the boiler.

The following table gives the results obtained by hourly periods:

Period in hours.	Average load kw.	Total Steam lb.	Steam per kw-hour, lb.
1	72.8	3,145	43.2
2	72.3	3,181	44.0
3	61.2	2,558	41.8
4	69.3	2,495	36.0
5	74.5	2,697	36.2
6	87.5	2,739	31.3
7	99.5	3,184	32.0
8	101.5	3,177	31.3
9	116.0	3,387	29.2
10	190.5	5,129	26.4
11	208.5	5,525	26.5

The average results obtained at half load were as follows:

Steam pressure, lb	143.7
Vacuum at Turbine, in	26.6
*Corrected Vacuum at Turbine, in	27.5
Vacuum at Air Pump, in	28.2
Load, kw	104
Steam per kw-hour, lb	32.4

*The corrected result was found by calibrating the gage with a mercury column.

The corrections specified under the guarantee may then be applied as follows:

Consumption obtained from curve, Fig. 6, at 150 kw, lb	28.2
Correction for boiler pressure—subtract 0.94 per cent, lb	=0.26
Correction for vacuum—add, lb	0.87
Corrected consumption, lb	28.81

As the guaranteed consumption at 150 kw with 150 lb. boiler pressure at 27-in. vacuum was 29 lb., the result obtained on test is 0.19 lb. better than the guarantee. No corrections were necessary for moisture in the steam as calorimeter readings taken at intervals indicated dry steam.

The average readings obtained on the full-load test were as follows:

Steam pressure, lb	136.8
Vacuum at Turbine, in	26.9
" " Air Pump, in	27.9
Load, kw	273.0
Steam per kw-hour, lb	26.3
Power Factor, per cent	100

The corrections specified under the guarantee for full load may then be applied as follows:

Consumption obtained from curve, lb	25.9
Correction for boiler pressure—subtract 1.9 per cent, lb	= 0.49
Correction for vacuum—subtract, lb	0.17
Corrected Consumption, lb	25.24

This is 0.06 lb. better than the guarantee of 25.3 lb. at 300 kw with 27-in. vacuum.

A study of the load curve in Fig. 7 for the period of the test is interesting as affording some idea of the daily life of the city. During the morning, and up to the middle of the afternoon, the load is mostly due to motors in mills or in elevator service. At noon the motor load falls off rapidly, and as half an hour for lunch is the rule in mills, the motor load rises at 12:30 p. m. About the middle of the afternoon some lighting load comes on, bettering the power factor, which up to that time averages 60, due to the inductive load of the three-phase motors.

At 5:30, due to the shutting down of the mills, the load again falls, but rises rapidly until the peak is reached about 8 o'clock. Usually on nights other than Saturday the load falls off at 8 or 9 p. m., continuing all night at about 60 kw. On Saturday night the peak continues until about 11 o'clock. As will be seen, with a load almost entirely free from motors, the power factor reaches 92.

In conclusion, it may be of interest to mention a few points brought out in the tests regarding the operation of the turbines.

A positive lubrication of all the bearings is maintained by means of an oil pump driven from the main shaft through gearing, this pump also supplying oil under pressure for operating the valve-control mechanism. The necessity of care in the selection of an oil for turbine use was forcibly illustrated by the trouble met with in the use of a good quality of engine oil, which was also supplied to the reciprocating engines and pumps in the plant.

In attempting to drain off the oil from the chamber in the base of the unit, it was found that the drain pipe was clogged. Examination revealed a dark jelly-like mass in the pipe and the oil was found to be of a light yellow, soapy appearance—in short, "saponification," as it is termed, had taken place. It was thought that the trouble was caused by the churning action of the pump acting on a vegetable component of the oil. A gas-

engine oil was then tried with good results, but the oil finally employed was one compounded especially for turbine use, and this gave entire satisfaction.

Some trouble was encountered in obtaining a good vacuum, the gage on the air pump showing no higher than 25 in. at no-load. Reference to Fig. 8 will give some idea of the cause of the trouble. A tap is made in the line supplying steam to the turbine to furnish steam for pressing the carbon-seal packing rings against the turbine shaft. A ¾-in. pipe is taken off the steam line close to the turbine, a globe valve, a reducing-pressure valve and a pop relief valve being located, as shown. The boiler pressure is reduced to about 12 lb., the relief valve serving to keep the pressure at this limit. At first a ½-in. branch, with a check valve, supplied the carbon seal at the high-pressure end of the turbine and a ¼-in. branch without any valve supplied the carbon seal at the low-pressure or exhaust end. Drips from both seals extended to a trench in the floor below, only that for the exhaust end being shown in the sketch.

It was surmised that the reason for the low vacuum was that air leaked in through the carbon packing at the exhaust end through the drain pipe, the end of which was open in a trench. A joint was broken in the drain pipe near the turbine and the end was plugged. The vacuum immediately increased to 29 in. The carbon packing was then examined and found to fit perfectly as far as could be seen.

A number of pockets were milled in the plate retaining the carbon packing to allow steam to condense in them and aid in making the packing tight. The steam branch was increased to ½ in., a globe valve being placed in the branch to both packings better to regulate the pressure. After this no further trouble was encountered and the vacuum was maintained at the guaranteed amount.

The plant is the property of the Equitable Securities Company, of New York, and is operated by the Pine Bluff Corporation, of Pine Bluff, Ark. Ford, Bacon & Davis, of New York, were the supervising engineers.

Experience with the Crystal Type of Wireless Detector.

By L. W. Thomas.

HAVING tested and tried out thoroughly several of the numerous types of crystal detectors put on the market in the last couple of years, there were found three that are superior to any of the others, namely, the Pickard perikon, the carborundum and the silicon. The carborundum and the silicon are very similar in their action, sensitiveness and manner of use, except that the carborundum is more reliable and dependable. As the carborundum and silicon detectors have a field of their own distinct from that of the perikon, the silicon will be eliminated and there will be discussed below the relative merits of the perikon and carborundum crystal, or, as sometimes called, thermo form of wireless detector.

The perikon detector, when correctly operated, was found to be superior to any other form of detector for long-distance work now in use, not excepting the most sensitive electrolytic or the DeForest "Audior." This detector, however, requires very careful handling, and its sensitiveness is so easily destroyed that a person not familiar with, or properly instructed in, its use is often disappointed and discards it as worthless or at best inferior to the other common form of detectors.

The perikon detector should be used only for long-distance work and kept free from sparks of any strong intensity. Even a testing buzzer connected directly instead of inductively will keep the crystals deadened, so that a sensitive place cannot be found. The spring tension between the two crystals also has considerable to do with the results obtained.

The perikon detector proper consists of two crystals or minerals, one of them being chalcoprites ($Cu_2SFE_2S_3$) and the other zincite (ZNO). A good form for mounting them is shown in the sectional diagram of Fig. 1.

From six to seven small pieces of the zincite are secured by mercury amalgam in a brass cup-shaped disk, 1⅛ in. in diameter, the disk being held stationary by a screw, as shown. The chalcoprites is mounted singly and eccentrically in the same manner in a cup ⅝ in. in diameter, and by a slight spring tension it is made to press lightly against the zincite. This crystal is mounted eccentrically and the holder on a swivel so that it can be swung and tuned and the most sensitive point of contact thus found. Usually there are found one or two places that are extremely sensitive.

The complete connections for the detector with a transformer type of timer are shown in Fig. 2. This diagram also shows a carborundum detector shunted around the perikon. A battery is not essential, but a single dry cell around a rather high-

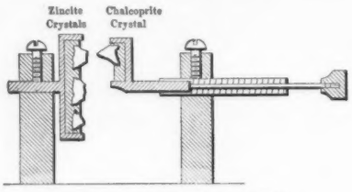


FIG. 1.—PERIKON DETECTOR.

resistance potentiometer, allowing about 0.05 volt across the crystals, keeps them livened and liable to less variation. The direction of current must be from the chalcoprites to the zincite A low-resistance telephone (of 400 ohms to 600 ohms) is preferable to a high-resistance telephone on account of the high resistance of the crystals, the resistance being in the neighborhood of 3000 ohms when making sensitive contact.

Should a strong spark or signal be received across the perikon it will instantly become deadened, the incoming signal being reduced in intensity as much as 65 per cent, but upon giving it a short rest—depending upon the intensity of the shock—its sensitiveness is restored. As the zincite is the only one of the crystals affected, by moving the chalcoprites to one of the other zincite crystals another place of sensitive contact may be found. Flat pieces of zincite, free from any foreign substance, and clear-pointed pieces of chalcoprites give the best results. When

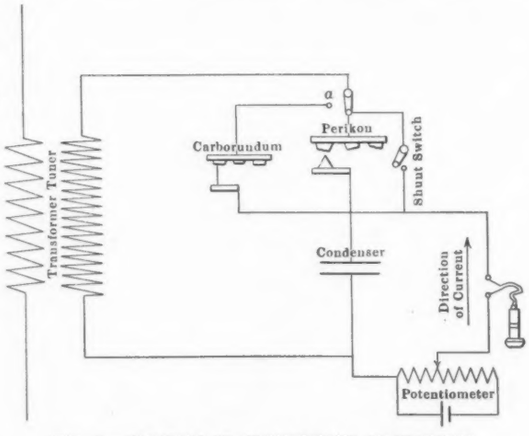


FIG. 2.—DIAGRAM OF CONNECTIONS OF DETECTOR.

transmitting is being done, the detector needs, of course, to be short-circuited or shunted.

While the perikon detector is adapted for long-distance work or for signals of weak intensity, the carborundum detector has its field in short-distance work, as it can withstand a spark of any intensity without being weakened in any way and thus making it extremely valuable for use aboard ship or where there are two or more stations in close proximity. While not as sensitive as the perikon and, therefore, not capable of doing the long-distance work of the perikon, signals from 1200 miles have been received on a very sensitive piece; the ordinary extreme range is not more than 300 miles.

An excellent way of making up a carborundum detector is

in the style of the perikon. A number of small pieces of the carborundum are mounted similar to the zincite crystals and a common steel needle, about 0.5 in. in length, takes the place of the chalcoprites and are soldered to the rim of the cup so that any piece of the carborundum can be reached and the most sensitive plate thereby located.

Carborundum varies greatly in its sensitiveness, but a somewhat flat, bright piece usually gives the best results. The spring tension of the needle against the crystal needs to be just sufficient to keep the needle from being easily disturbed by a jar. The carborundum detector does not require a battery, and, as with the perikon, a low-resistance telephone is preferable. There is very little, if any, difference whether the needle point or the crystal side is connected to aerial.

By using the carborundum in connection with the perikon detector there is obtained a most satisfactory combination which will receive signals of the strongest or weakest intensity, the carborundum detector being simply shunted around the perikon, as shown in Fig. 2. A switch shown at *a* is used to cut in either detector, depending upon the character of the signal being received. The carborundum needs no short-circuiting switch when transmitting, as it is not affected by the spark. The receiving signals of both the perikon and the carborundum can often be improved by cleaning the crystals with carbon disulphide.

No-Load Conditions in Self-Excited, Single-Phase, Shunt-Induction Motors—I.

BY VAL. A. FYNN.

IT is of interest to consider just how the no-load conditions and the design of self-excited, single-phase, shunt-induction motors are affected by the torque conditions existing in such machines and which have been discussed by the author in a paper read before the Birmingham Local Section of the British I. E. E. on Dec. 11, 1907. The partly or self-compensated motor shown in Fig. 1 will be considered first, the investigation being afterward extended to the wholly or artificially compensated motors shown in Figs. 2, 3, 4 and 5. It is to be understood that those of the considerations here set forth which relate to Fig. 1 apply equally to machines of that type, but provided with a squirrel-cage or with a slip-ring rotor.

The terminology employed by the author is that proposed by him in "Classification of Alternate-Current Motors." Thus the "self-excited, self-compensated, single-phase, shunt-induction motor" is the machine commonly referred to as the "single-phase induction motor." Fig. 1 illustrates that form of this machine in which the induced member is short circuited by way of a commutator along two stationary axes displaced in space with respect to each other. In the more common form of this machine, the induced member is short circuited along at least three axes, which do not alter their relative position with respect to the induced member, whether the latter revolves or not; such motors generally have either a short circuited, three-phase winding or a squirrel-cage on the induced member.

The author has shown elesewhere that these induction motors have limited self-compensating properties; these will be referred to later. They become "wholly or artificially compensated" when there is added some compensating device such as is shown in Figs. 2, 3, 4 or 5; such devices necessitate the use, on the induced member, of a winding connected to a commutator, but do not exclude the simultaneous use of a secondary winding short circuited independently of a commutator.

In order to fix ideas, consider first an *ideal* motor of the type shown in Fig. 1—that is, one which is entirely devoid of losses and is quite symmetrical in all directions, and let this machine be *mechanically driven*, not only at an absolutely synchronous speed, but also with a constant angular velocity. The diagram illustrating the performance of such a machine under the conditions stated becomes very simple and is shown in Fig. 6. An e.m.f. P impressed on Z_1 will determine the

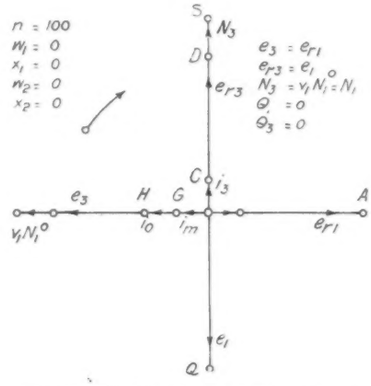
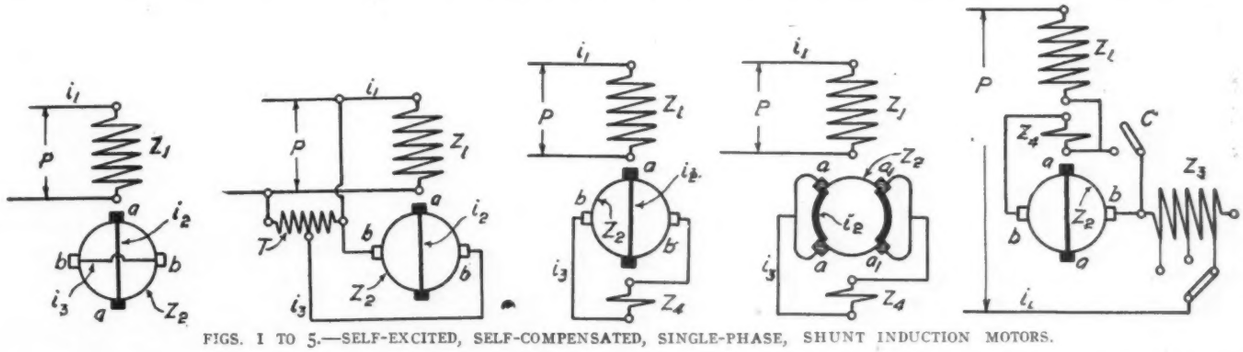


FIG. 6.—TIME-PHASE DIAGRAM OF AN IDEAL MOTOR OF THE TYPE SHOWN IN FIG. 1 WHEN MECHANICALLY DRIVEN AT A SYNCHRONOUS AND UNIFORM SPEED.

magnetizing current i_m and produce a flux of mutual induction $v_1N^o_1$ along the axis *a a*. This flux will induce the working e.m.f. e_1 at the brushes *a a*. By rotation of the rotor conductors in $v_1N^o_1$ an e.m.f. shown at e_{r1} is generated at the brushes *b b*. This e.m.f. determines the rotor magnetizing current i_3 and produces the motor flux N_3. By rotation of the rotor conductors in N_3 the back e.m.f. e_{r3} is generated and appears at the brushes *a a*. The magnetizing current i_3 is reflected along the rotor axis *a a* in a manner presently to be explained and is counterbalanced by an equal and opposite component in Z_1; the total primary current is here equal to the sum of i_m and i_3. Such a motor will require no irrecoverable energy to run it light, hence the product of the effective component i_{i2} of the armature current i_2 multiplied by the back e.m.f. (e_{r3}) should be nil.

Since the motor field N_3 has a definite value, then e_{r3} will be greater than zero and consequently i_{i2} can be zero when e_{r3} equals e_1 in magnitude and exactly opposes it in phase. If sinusoidal time-values be assumed for all fluxes, an assumption which must be adhered to throughout in order to simplify matters sufficiently, then this condition will be reached at synchronous speed for, say, $n = 100$. At that instant, and for the direction of rotation of the motor which has been



FIGS. 1 TO 5.—SELF-EXCITED, SELF-COMPENSATED, SINGLE-PHASE, SHUNT INDUCTION MOTORS.

chosen, $e_{r3} = e_{r1} = e_1$; also $i_2 = i_3 = i_m$, $i_0 = i_m + i_3$ and $N_3 = v_1 N^0_1$; furthermore, the motor field N_3 leads the transformer field $v_1 N^0_1$ by exactly 90 time-degrees, as shown in Fig. 6.

Before proceeding, the writer would like to take this opportunity to dwell at greater length on some points connected with the diagram shown in Fig. 6, and about which questions have often been asked.

The conventions he generally makes use of in constructing vector diagrams are as follows: A direction from left to right and from top to bottom of the paper is considered positive, as

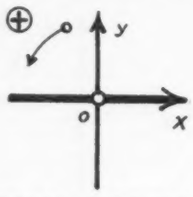
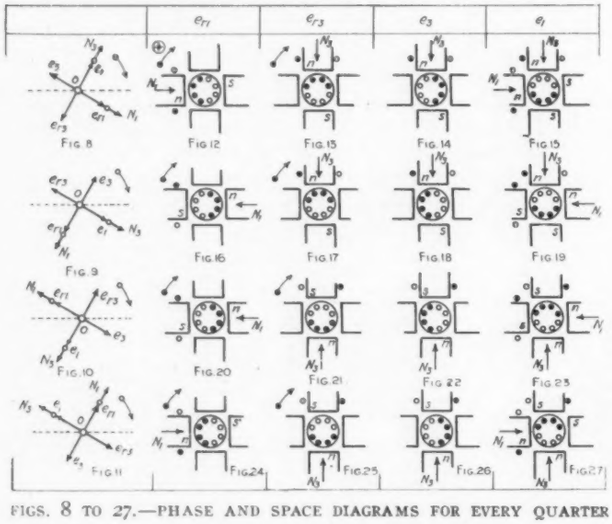


FIG. 7.—CONVENTIONS UNDERLYING FIGS. 8 TO 47.

shown in Fig. 7, by the co-ordinate axes X and Y. The X axis, shown thick, is taken as reference line. The positive direction of rotation of a vector, or the progress of time, is clockwise. This is indicated in Fig. 7 by an arrow provided with a small circle. Similarly, a clockwise rotation of the rotor is termed positive, while counterclock rotation is referred to as negative. The direction of rotation of the rotor is indicated in the following figures by an arrow provided with a small black dot.

With these conventions in mind, one can now show how the phase and direction of the principal vectors in Fig. 6 can be arrived at with the help of the ordinary rules governing electromagnetic phenomena. While the vector diagrams Figs. 8 to 11, in the first vertical row, show phase, direction and magnitude of all the vectors at every instant, the space diagrams of Figs. 12 to 27, and all similar figures, can only show the relative directions of e.m.fs., currents and fluxes at any selected instant. All the space diagrams in the same horizontal row (Figs. 12 to 27) are, therefore, directly comparable. All space dia-



FIGS. 8 TO 27.—PHASE AND SPACE DIAGRAMS FOR EVERY QUARTER CYCLE AND A CLOCKWISE ROTATION OF THE MOTOR SHOWN IN FIG. 1.

grams in the second vertical row are specially devoted to a representation of the instantaneous direction of e_{r1}, the e.m.f. generated in the rotor along the motor-field axis $b\,b$ of Fig. 1. Those in the third vertical row are devoted to a representation of e_{r3}, and so on. It is assumed that the transformer axis $a\,a$ of Fig. 1 coincides with the X axis of Fig. 7. Since for the moment an ideal motor is assumed, the whole of the flux due to Z_1 must thread both the stator and the rotor, and $v_1 N^0_1$ will equal N_1. All the figures from 12 to 27 refer to a positive rotation of the rotor, and it will soon be recognized that these figures give a complete graphical representation of the manner in which the motor shown in Fig. 1 really operates.

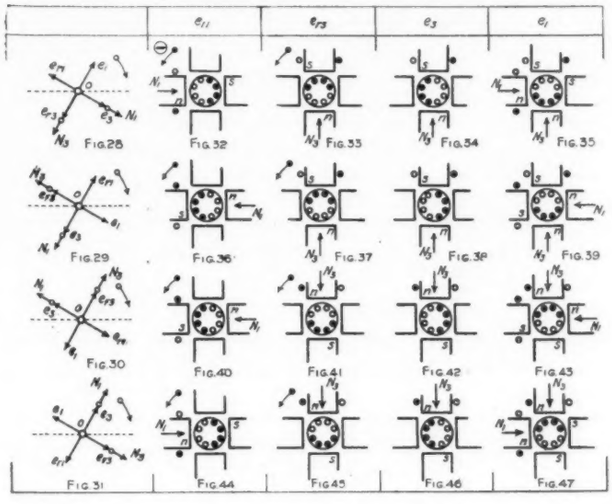
Assume that the vector N_1, representing the maximum amplitude of the transformer flux, has the position shown in Fig. 8. Referring this vector to the X axis, it will be seen that its value at that instant is a positive one. The direction of the flux N_1 in Fig. 12 will accordingly be from left to right, thus the pole to the left of the rotor will be a north pole. It will be appreciated that the direction of an e.m.f. *generated* in a conductor revolving clockwise past a north pole is *downward* through the plane of the paper; and the e.m.f. generated in a conductor revolving in the same direction past a south pole is *upward*, through the plane of the paper. The direction of the e.m.f. in all the rotor conductors to the left of the vertical axis may then be indicated by black dots (downward); that to the right by circles (upward). To establish a correspondence between the direction of an e.m.f. (or a current) in the rotor conductors and the direction of a flux, such as N_1, it is only necessary to determine the direction of that flux which would be produced if it were due to a rotor current of same direction as that of a given rotor e.m.f. It is clear that in the case of Fig. 12, such a flux would be positive—that is, directed from top to bottom of the paper; therefore, the direction of e_{r1}, in Fig. 12, is referred to as positive, and the vector of e_{r1} must be shown as coinciding with N_1 in Fig. 8. In this case the e.m.f. due to rotation in N_1 is consequently not only of the same phase, but also of the same direction as N_1. The stator winding producing N_1 is indicated by a dot and a circle at either side of the pole n in Fig. 12. The magnetizing current i_m is of the same phase and direction as N_1, and, therefore, positive at the instant under consideration. This positive current i_m (not shown in Fig. 8) must flow *up* (circle) above n and *down* (dot) below n.

Since the flux lags 90 time-degrees behind the impressed e.m.f., N_3, due to e_{r3}, will lag 90 time-degrees behind the latter, as shown in Fig. 8. Referring N_3 to the X axis, it is found to be positive, and is accordingly shown in Fig. 13 as being directed from top to bottom of the paper. The magnetizing current i_3 (not shown in Fig. 8) being of the same phase and direction as N_3, in Fig. 13, is directed *up* on the right of the north pole n and *down* on the left of it. (As a matter of fact, i_3 flows *in the rotor* along the axis $b\,b$ and not in the winding disposed on the stator, as shown in Fig. 13, and in other figures. In order to show clearly the direction of i_3 in the rotor it would have been necessary to add another vertical row to each set of these space diagrams; to avoid doing so, the direction of i_3 has been shown on the stator instead. If diagrams of this kind are ever used for teaching purposes it will no doubt be preferable to add a vertical row of diagrams for every factor it is desired to illustrate, thus, for i_3, i_2, i_0, and so on. By showing the direction of i_3 on the stator, as in Fig. 13, without further explanation, the erroneous idea might be conveyed that a two-phase motor was being dealt with). The e.m.f. *generated* in the rotor conductors by rotation in N_3 must be directed downward in the top half and upward in the bottom half of the rotor. A field produced by a current distributed and directed, as indicated, would be directed against N_1; e_{r3}, is, therefore, negative. It is known that e_{r3} must be of the same phase at N_3, and having found that it is negative, the position of its vector is undoubtedly defined as being in opposition to that of N_3—that is, of the same phase as, but opposite in direction to, N_3, as shown in Fig. 8. It will now be understood why e_{r1} is of the same phase and direction as N_1, whereas e_{r3} is simultaneously of the same phase as, but of opposite direction to, N_3.

Reverting to *induced* e.m.fs., it is known that the latter lag 90 time-degrees behind the fluxes to which they are due; thus e_3, in Fig. 8, lags 90 time-degrees behind N_3. By referring e_3 to the X axis it is seen that e_3 is negative; the distribution of this e.m.f. is shown accordingly in Fig. 14. Fig. 15 shows in the same manner the distribution of e_1, which is positive, at the instant chosen, since it lags 90 time-degrees behind N_1, as seen in Fig. 8.

Comparing Figs. 12 and 14, also 13 and 15, it may be noted that e_3 opposes e_{r1} and that e_{r3} opposes e_1. These same figures

also give every information as to torque conditions. It has been said that a current of the same phase and direction as the working e.m.f. (e_1) should produce the main or positive torque of the machine in conjunction with the motor field N_3. A reference to Fig. 15, where both fluxes N_1 and N_3 have been indicated, shows that a current of same direction as e_1 would flow *up* under a *north* pole and *down* under a *south* pole of N_3; these conditions result, as is known, in a pull on the conductors in a clockwise direction, which in this case is the positive direction. The direction of other torques, when such exist, can be ascertained in like manner and will be found to agree exactly with the statements contained in the author's Birmingham paper.



FIGS. 28 TO 47.—PHASE AND SPACE DIAGRAMS FOR EVERY QUARTER CYCLE AND A COUNTER-CLOCKWISE ROTATION OF THE MOTOR SHOWN IN FIG. 1. CONVENTIONS AS LAID DOWN BY FIG. 7.

The three succeeding horizontal rows show the conditions obtaining after the lapse of one, two and three quarter-cycles, as reckoned from the position of the vectors shown in Fig. 8, and clearly illustrate the various stages through which each of the factors involved passes during one complete revolution of a two-pole rotor. It is thought that these diagrams do not require further explanation.

The effect of reversing the rotation of the rotor is shown by means of the space diagrams Figs. 32 to 47, the corresponding phase diagrams being those of Figs. 28 to 31. Fig. 28 corresponds exactly to the diagram shown in Fig. 6, which, therefore, depicts a counter-clockwise rotation of the motor. One of the points of interest is that e_{r1} is now of the same phase as, but of opposite direction to, N_1; whereas e_{r3} is not only of the same phase as, but also of same direction as, N_3.

The conventions underlying the above diagrams may be

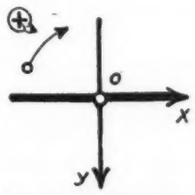
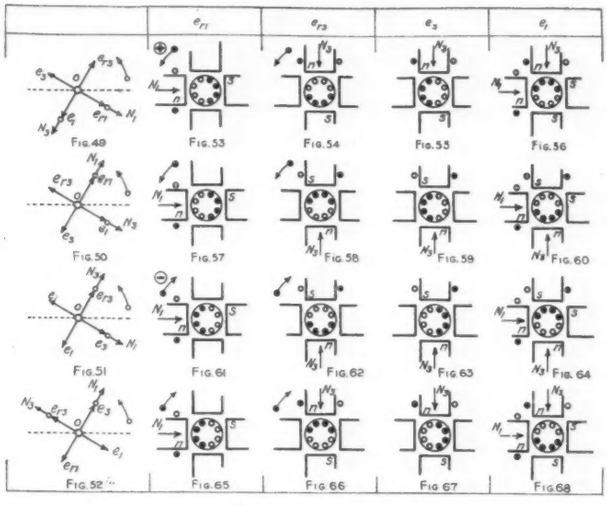


FIG. 48.—CONVENTIONS UNDERLYING FIGS. 49 TO 68.

altered without in the least vitiating the results. Very often the direction from left to right and from top to bottom of paper is taken as positive, while the progress of time is measured counter-clockwise, as shown in Fig. 48. The positive rotation of the rotor is then said to be counter-clock. It was thought useful to illustrate also the performance of the motor by means of diagrams based on the last-mentioned conventions. These diagrams are represented in Figs. 49 to 68, and show conclusively that results identical to the previous ones are obtained for both directions of rotation.

Figs. 49 to 50 show vector diagrams for two instants differing in time by one-quarter of a cycle, and Figs. 53 to 56 and Figs. 57 to 60 represent the corresponding space diagrams, the rotor revolving in a counter-clock direction. The phase diagrams Figs. 51 and 52, and the corresponding space diagrams, Figs. 61 to 68, indicate the conditions when the direction of rotation of the rotor is a negative one or clockwise. All these diagrams should be understood without further explanation after what has already been said.

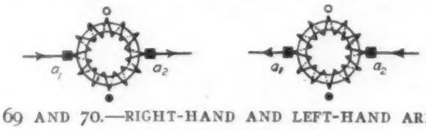
There remains just one more point to consider when applying



FIGS. 49 TO 68.—PHASE AND SPACE DIAGRAMS AT AN INTERVAL OF ONE-QUARTER CYCLE AND COUNTER-CLOCKWISE ROTATION OF THE MOTOR SHOWN IN FIG. 1.

these diagrams to an actual machine: this refers to the direction in which the rotor is wound. In Fig. 69 is shown what is termed a *right-hand* Gramme ring. If the current is to be sent through that winding in a positive direction, such, for instance, as shown in Fig. 15, then, according to the conventions adopted by the author, this current must enter at the brush a_1 and leave at a_2—that is, it may be said also to pass the brushes in a positive direction. If the armature is a *left-handed* one, as shown in Fig. 70, then the current must pass the brushes in a negative direction in order to flow through the rotor windings in a positive one.

Reverting to Fig. 6, it is quite clear that when the machine is driven at a strictly synchronous speed in a field $v_1 N^0_1$, then e_{r1} must be generated at the brushes *b b*, in Fig. 1, and this must cause a current i_3 to flow in the rotor along that axis *b b*. When the local impedance of the rotor circuit is zero, as is the case in the ideal motor being considered, then i_3 will lag just 90 time-degrees behind e_{r3}, and the flux due to i_3 will induce an e.m.f. (e_3) of exactly equal magnitude and exactly opposite phase to e_{r3}. The resultant e.m.f. in the rotor along the axis *b b* will be zero and yet i_3 will exist; indeed, i_3 must exist in



FIGS. 69 AND 70.—RIGHT-HAND AND LEFT-HAND ARMATURE WINDINGS.

order that e_3 may exist and the magnitude of i_3 will reach its limit when N_3 has become sufficiently large to induce an e_3, which is just equal and opposed to e_{r3}. Here, then, is a case where zero e.m.f. divided by zero impedance results in a current of quite definite magnitude. This case is, in fact, identical with that of an ideal transformer the secondary of which is on open circuit.

The vectorial difference between the two e.m.fs. (e_1) and e_{r3} acting in the rotor, along the axis *a a* is also nil and so is the local impedance in that axis, and here again one is confronted

by the indefinite expression "zero e.m.f. divided by zero impedance."

In the case of the axis $b\,b$ there is an essential physical reason why a current i_b of a definitely limited value should flow. Here there is no such reason, because e_1 is due to $v_1 N^o_1$, and e_{r1} to N_2. If a current does flow along the axis $a\,a$, the field it produces will have to be immediately and fully neutralized, otherwise the operation of the motor must be impaired. All that can be said in this case is that there is no apparent physical reason why a current should not flow *if* provision can be made for neutralizing the magnetization due to it. It will be shown later that in the case of a practical machine having local impedance in the rotor, e_3 is not quite in phase opposition to e_{r1}, nor is it quite of the same magnitude as e_{r1}. The vectorial difference is of just the magnitude and phase required to produce a current i_b of the required magnitude, and this difference is faithfully reproduced in the rotor along the axis $a\,a$, as the vectorial difference between the e.m.fs. (e_1) and e_{r3}, with the result that i_b is also more or less faithfully reproduced along that axis, the more faithfully the smaller the rotor impedance. Dr. A. S. McAllister has shown that since i_b is more or less faithfully represented by a current i_2 along the axis $a\,a$, when the local impedance is not zero and since i_2 approaches the magnitude of i_b the more closely the smaller the local impedance of the rotor, then i_2 must exactly equal i_b when that impedance becomes zero in the case of a motor *driven by external means* at a uniform and synchronous speed. But if a current i_b equal to i_b in magnitude and in phase and space quadrature thereto is present in the rotor along the axis $a\,a$, then the ampere-turns due to it must be neutralized and the primary winding Z_1 consequently takes a current $i_o = 2\,i_m$, or, more generally, a current $i_o = i_m + i_2$, thus:

The no-load current required by an ideal self-excited, single-phase, shunt-induction motor driven at a strictly uniform and synchronous speed is equal to the sum of the stator and rotor magnetizing currents.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric Light in Baltimore Markets.

Several of the largest markets of Baltimore are now undergoing an electrical renovation. A few months ago Lexington Market, one of the largest open markets in the country, was thoroughly overhauled by the city, the old wiring was removed and each stall was put on a separate meter. In addition to this, a large electric sign was placed at the main entrance. The electrical work involved a considerable outlay and the city did not intend to make at this time similar improvements in other markets; demands, however, were so urgent that suitable appropriations were made and the work of giving Broadway and Cross Street markets better electric service has been begun. All of the open wiring is being replaced by conduit, the fixtures will be of a uniform design and each stall will have its individual meter. Large-size tungsten lamps will be used for the general illumination. The merchants in the vicinity of other markets are desirous of having these supplied with the same type of sign as that erected over the Lexington Market, and the Board of Estimates has this matter under advisement. The second floors of these markets are utilized for halls in which to hold various public meetings, and these rooms are also being newly wired and supplied with the most modern fixtures.

Electrical Energy Required for Water Pumping.

Electric light and power companies which are figuring on securing water-pumping contracts will find of interest the following figures, which were obtained in actual practice: At Columbus, Neb., Mr. John T. Burke, manager of the Columbus Light, Heat & Power Company, which has a contract to pump electrically the water for the water works, recently made a careful test on the electrical energy required to pump a given amount of water. Mr. Burke finds that under the conditions at Columbus it requires 700 watt-hours to pump 1000 gal. of water against 100-ft. head. The measurement was taken by noting the rise of water in a standpipe. The pump used is of the triplex type, motor-driven, rated at 390 gal. per minute. The suction lift is 10 ft. and the discharge 90 ft. The pump is equipped with a 35-hp motor. Under ordinary conditions (which prevailed during the test) only 15 hp is required. The extra motor capacity is provided so that the pumps can be made to do fire service at high pressure.

Mr. H. C. Morrow, manager of the Whitehall Electric Company, stated at the recent convention of the Illinois State Electric Association that at Whitehall, Ill., 22 kw-hours are required to pump 15,000 gal., or 1333 watts per 1000 gal. with 120-ft. lift.

Whitehall (Ill.) Single-Phase Transmission.

The Whitehall Electric Company, of Whitehall, Ill., supplies electricity to the Greenfield Light & Power Company and also to the Winchester Electric Company. Greenfield is 12 miles from Whitehall and Winchester is 13 miles. Both are supplied with electricity by a 16,500-volt, single-phase transmission line. The transmission lines are built just outside of railroad right-of-way, the right to set such poles being given by the farmers. In distributing these poles an arrangement was made with the railroad company whereby a freight train was run at slow speed over that part of the railroad to be paralleled by the transmission line. A car loaded with the poles was placed in this train, and four men were provided to unload these poles at regular intervals. The points to throw off poles were marked by pieces of red cloth tied to the fence. In this way the poles were distributed at comparatively slight expense.

Electric Power in the Black Hills Mining District.

The famous Homestake mine at Lead, S. D., the largest gold mine in the United States, is preparing to develop a water-power for its own use on the Spearfish River in the Black Hills. This water-power will have 700-ft. head, and the amount of power available will vary from 3500 hp to 10,000 hp. This mine has already made a good start in the introduction of electric power, and purchases considerable quantities from the Consolidated Power & Light Company and the Black Hills Traction Company, both of which have distributing and transmission lines over the Black Hills mining district. The Homestake mine now has 16 25-hp motors, operating one of its stamp mills with power purchased from the Black Hills Traction Company. In equipping a stamp mill with motors the practice has been to operate one bank of 10 stamps from one motor. When a stamp mill is steam-driven, it is operated from a lineshaft with a steam engine at one end. In another mill the Homestake mine has 10 25-hp motors which are operated from a small water-power plant owned by the mining company. A contract has recently been let to electrically equip a third stamp mill, and it is likely that the work of electrically equipping much of this mining company's machinery will go steadily on from this time in preparation for the electric power to be supplied from the new plant. A plant for the treatment of

slimes operated by this company at Deadwood is electrically operated with power purchased from the Consolidated Power & Light Company.

The Black Hills Traction Company and the Consolidated Power & Light Company have until recently operated independently. They are now operating in parallel, which gives both systems a chance to operate more economically. The Consolidated Power & Light Company has a thoroughly modern steam turbine plant at Pluma. This has two 1500-kw, 11,000-volt Curtis turbo-alternators and one 500-kw, 2300-volt turbo-alternator. Distribution to the various lines is accomplished at 11,000 volts. The local lighting and power distributions in Deadwood and Lead are the standard 2300-volt systems. The Black Hills Traction Company has a 1000-kw water-power plant and a steam plant employing a 500-kw Westinghouse turbine. Its transmission lines operate at 24,000 volts. This company does practically nothing but a wholesale business, selling power to mines. Some of this mining business has an excellent load factor, records showing from 69 to 90 per cent load factor, estimating the maximum load as being the connected horse-power. This is the ratio of the average load to the connected horse-power.

Heating Devices and Increase of Residence Revenue in Denver.

Mr. C. N. Stannard, secretary of the Denver Gas & Electric Company, says that about half of the residence customers of that company are supplied with electric irons. The work of introducing them still continues. The irons recently placed are the American and the Pelouze, the sale price being $5 for the American and $5 for the Pelouze.

The company is just starting to put out 1000 General Electric vertical toasters. These will be put out on 30 days' trial, like the irons.

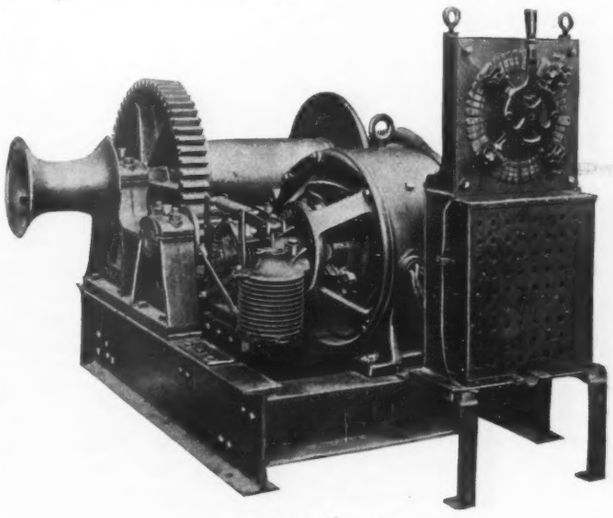
The company still continues the practice of employing a certain number of service supervisors whose duty it is to visit consumers having electric service, with a view to correcting any defects in service and getting in as many new energy-consuming appliances as possible. The plan, which has been described before in these columns, is to assign to each of the seven service supervisors a certain number of consumers, which they are supposed to visit within a certain period. This service supervision work has now gone on a sufficient time, so that the supervisors are on their second round; thus all the consumers have been visited once and are now being seen again. A gratifying thing about this work is that the supervisors are making more money for the company on the second than they did on the first trip.

An Enterprising Small Central Station.

The possibilities of electric lighting in small communities is illustrated by the history of a small electrical generating plant established the present year at Intercourse, Lancaster County, Pa. The owners of a grist mill in the town, which has a population of less than 1000, installed last summer a 50-kw, three-phase alternator, switchboard and 90-hp engine, and upon starting up had a large store, which they equipped throughout with tungsten lamps, as the only customer. At present a considerable number of residences, hotels, stores and factories are connected. Moreover, a transmission line 2¾ miles long is being built, over which will be supplied neighboring towns, namely, Leaman Place, Paradise and Gordonville. The line will be operated at 2300 volts, and quite a considerable power business is anticipated, as when the transmission line is completed the plant will be in operation 24 hours per day. A recent addition to the customers is the Woods Lane duck farm, which is one of the institutions of that section of the country. Tungsten lamps are being installed throughout, and the electric light will be used in connection with feeding the ducks after dark, as a means of getting them on the market earlier than usual. The plant is operated on the meter basis, which has been found entirely satisfactory. In taking on a customer the connection to his place is installed free of charge if within a reasonable distance of the main line. The rates are 12 cents per kw-hour up to 50 kw-hours per month, and 10 cents per kw-hour beyond that consumption. Mr. Enos L. Zimmerman is manager and part owner of the plant.

Renting Electrical Hoists at Rochester, N. Y.

In most of the smaller cities, the building contractors have not enough capital to enable them to invest in the ordinary, though expensive and excellent, hoists developed for electric service, the use of which is thoroughly justified in larger cities. Moreover, construction work in smaller cities is not continuous enough to warrant carrying this expensive equipment owned outright by each individual contractor. The Rochester Railway & Light Company has therefore been forced into the development of a cheap, assembled hoist made from standard parts and which is capable of adaptation to direct-current or alternating-current circuits. Complete control is had by means of a rheostat of the railway type, the motor being reversed in



CONTRACTORS' HOIST.

direction of rotation for descending loads. A solenoid brake is substituted for the ordinary foot-lever brake and standard back-geared motors are employed, the back-gear bearings being made to fit an intermediate shaft from which the motor swings much in the same way as does a street-car motor. The outboard end of the motor is flexibly attached to the bed plate and in place of the control arrangement shown in the illustration it is proposed to attach the controller to the motor body and to suspend the control resistance from the bottom so that either motor with its resistance control and solenoid brake complete may be removed by lifting the caps on the intermediate shaft bearings. The hoist will also be provided with complete cast-gear cases, as the common practice in the use of exposed gears is felt to be grossly inhuman. Enclosing shields are used on the motors to protect the commutator, etc.

Direct current is available in certain sections of Rochester and alternating current in other sections, so the base has been arranged for the substitution of a direct-current for an alternating-current motor or vice versa. In approaching building contractors the following points are emphasized by the solicitors: The hoist is compact, portable and self-contained; there is no fuel to cart; no smoke nuisance; a maximum facility of control is afforded; the apparatus is equally economical at all loads; in lowering loads, the electric meter runs backward; the power control and brake are both operated by one hand; the brake is absolutely automatic in case of service interruption.

The hoist weighs 3300 lb. and is equipped with a 15-hp motor. Its hoisting capacity is 2200 lb. at 175 ft. per minute, or 4400 lb. at 88 ft. per minute. The contractor, if he so desires, may purchase the hoist complete with controller for $675, or the company will rent the hoist for $2 a day with a minimum charge of $10, and will deliver the hoist on the site of operations ready for work. The company also holds in stock an alternating-current motor with which to replace the direct-current motor when the apparatus is used in the outlying districts of Rochester. The substitution is made without cost to the contractor and the rates for energy are those approved by the Public Service Commission and published by the company. Based on the daily use of the connected load the rate varies from 8 cents to 2½ cents per kw-hour subject to various discounts. The Rochester Railway & Light Company has gone into the question of rates very extensively from the viewpoint of both the company and the consumer, and details of its system of rates were published in the Feb. 4 number.

Electric Vehicle Discussion at Illinois Convention.

At the convention of the Illinois State Electric Association, held at Alton in October, Mr. H. W. Dickerman, of Rockford, Ill., in a paper entitled "The Relation of the Electric Vehicle to the Central Station," reviewed the results of a set of inquiries directed to central-station companies in Illinois. The writer seven years ago was in the employ of the Rockford Edison Company, where he became enthusiastic over the electric automobile and took an agency with the consent of the management. The first electric vehicles received were crude. The total business the first year consisted of the sale of two vehicles; the second year 17 vehicles were sold. After getting a good start in Rockford other towns were visited, but with much disappointment. When he first visited St. Louis the central-station management showed no interest in the electric vehicle, but later the Union Electric Light & Power Company established one of the largest electric vehicle garages in the country, which has resulted in the extensive development of the business in St. Louis. In Kansas City, also, no encouragement was received at first, but for two years past the central-station management there has operated an electric garage.

The mercury-vapor rectifier sets brought out in recent years for charging vehicles from alternating-current supply are excellent aids to the business, on account of their low cost and automatic features which prevent the overcharging of a battery. Central stations are giving much attention to pushing the sales of flatirons and small appliances, but a few electric vehicles will take more electrical energy than many flatirons.

Mr. F. H. Golding, of Rockford, said there are 57 private garages and six public garages now connected to the Rockford Electric Company's lines. The average yearly revenue for all vehicles in the city was $60 per vehicle, and for cars kept in private garages, $48 per vehicle. In the private garages there is no need of watching consumers to see that they do not use electricity during peak-load hours on a non-peak contract. This takes care of itself automatically, because the user seldom wishes to charge his vehicle early in the evening, since it is not convenient to do so. He prefers to set it to charging the last thing at night and leave it charging all night or until it is cut out automatically. The rate for charging to electric vehicle owners is 6 cents per kw-hour. Public garages get 1 cent discount to provide for resale at 6 cents to the vehicle owner. The garages are on a non-peak contract providing that electricity shall not be used for charging from 4 p. m. to 9 p. m. The public garages are not so careful about observing the non-peak clause as are the private garages. The central-station company took charge of the batteries of vehicles operating in the city for a number of years, and owners now understand the care of batteries better than formerly. Although the Rockford Electric Company has discontinued the care of vehicles and batteries, it has had virtually to resume this work again, acting through a former employee who understands battery maintenance. In general, Mr. Golding favored the care of vehicles at public garages, as the batteries are then more likely to receive proper attention. Mr. Dickerman on the other hand favored the keeping of vehicles at private garages on the ground that they are likely to receive better care.

Mr. John F. Gilchrist, of Chicago, reported that the Commonwealth Edison Company is operating 18 3000-lb. wagons in its supply department, and has found that they are more economical than horses where they are in service where speed is possible. There are about 2300 electric passenger vehicles in Chicago. The possibilities of income from the electric vehicle can be seen when the amount of money spent annually in feeding horses at present is considered. There are said to be 80,000 horses in the city of Chicago, costing an average of $125 a year each, or a total of $10,000,000. While one can hardly figure on displacing all horses, the revenue by displacing even a part by electric vehicles would be considerable.

Mr. Golding said that some Rockford people have both electric and gasoline vehicles, but the gasoline vehicle is used very little as compared to the electric. Mr. E. W. Smith, of Kewanee, reported one consumer who has two electric vehicles and one gasoline vehicle. The electric vehicles are used all the time, but the gasoline touring car is seldom taken out. Mr. Smith's own electric vehicle has been run six years with two sets of batteries. The rate for charging is 6.3 cents per kw-hour on a non-peak contract. The attention of consumers is called to the non-peak clause by means of a card.

Mr. J. G. Learned, of Chicago, spoke of the plan of having a regular flat-rate sign patrolman turn off garages during the peak-load period. One member inquired as to how many electric vehicles one man could take care of. Mr. Golding thought 40 to 50. In Rockford the man doing this work charges 50 cents per week for inspection and small repairs, and has 50 cars under his care, which are brought in for his inspection. Mr. Dickerman reported that in St. Louis a man makes a business of visiting cars in private garages once a week for inspection at a charge of $5 per month. Mr. N. M. Argabrite said that a special direct-current automobile charging feeder which was maintained at Winona, Minn., showed that automobile charging is not usually done on the peak.

Gas and Gasoline Competition.

Mr. John G. Learned, of the North Shore Electric Company, Chicago, read a short paper on "The Advantages of the Tungsten Lamp" at the Illinois State Electric Association convention at Alton in October. He summed up the advantages of the tungsten lamp as follows: Better color value than other illuminants; higher efficiency than carbon-filament lamps; saving in the original cost of wiring installations because of the decrease in necessary wattage, and ability to compete with gas. So severely have the gas interests felt tungsten-lamp competition that numerous imitations of the tungsten lamp have been brought forth. Inverted mantles in clusters, with reflectors, were brought out to try to supplant the now common tungsten clusters. The latest is the new "tungsten" gas mantle. The number of consumers who will put up with the inconvenience of gas lighting are becoming less and less. The gas companies have a serious problem to contend with, in the inherent difficulties of their product when used for lighting. The advantages which the tungsten lamp has over the gas-mantle burner were brought out in some recent competitive tests of the series tungsten lamp versus the gas-mantle burner, in which it was discovered that it was impossible to maintain the rated candle-power of the mantle under actual conditions in the street, as compared with the series tungsten lamp. Until the coming of the tungsten lamp, the majority of places using carbon-filament lamps were not sufficiently lighted, and when the central station offers three times the light for the same money it is eagerly accepted. It is to the advantage of the central station to recommend the liberal use of high-effi-

ciency lamps. It is needless to advise the general use of the lamp, as it seems inevitable that with proper exploitation the income will materially increase as business on the lines becomes more dense.

In the discussion of the paper, Mr. F. H. Golding, of Rockford, said he had found the tungsten lamp a great help in competing with gas. Lighting solicitors are required to study and apply illuminating engineering, using Cravath and Lansingh's book on "Practical Illumination" and their tables. The general aim is not to reduce a customer's bill, but to produce more light. In case it is found that a customer is about to make an installation in which the light will surely be insufficient, the solicitor writes the customer a letter of protest. This puts him in a better position to talk after the lighting installation has been tried and found wanting than if he allowed it to go in without comment. In regard to the making good of broken tungsten lamps brought back by purchasers, Mr. Golding said that if a tungsten lamp burns out within three days, or blackens, his company will renew it. Many lamps, however, are put out through the local contractors, who purchase them at the company's office. Mr. Hadley, of Canton, thought it best to sell to the contractor only in standard packages, so as to prevent controversies. Mr. Golding replied that it was a great convenience to the contractor to be able to purchase lamps in small quantities. Mr. N. M. Argabrite, of Belvidere, stands back of lamps sold for a few days. The lamps are dated with the date of sale in an inconspicuous manner. Mr. F. M. Sinsabaugh, of Carrollton, also makes it a practice to date lamps when sold. Mr. E. G. Schmidt, of Springfield, said that companies need not be afraid of reduction of wattage with tungsten lamps, as people want more light rather than lower bills. Mr. Sinsabaugh had found the same thing. Mr. E. W. Smith, of Kewanee, said that if a ½-watt per candle lamp came on the market it would be welcome; it would still further help the business. The effect of the tungsten lamp at Kewanee has been to broaden out the daily peak load. One member reported some trouble from an "anti-wattage" contractor. Mr. F. H. Golding reported very cordial relations between his company and the four contractors in the town. The company acts as adviser to a consumer, drawing plans and specifications for wiring. Of all specifications, four copies are made, so that all the contractors can bid on them if they desire. The company supervises the installation for the consumer. The aim is to make the consumer's lighting as near right as possible, without regard to whether it increases or decreases the connected load.

Mr. J, R. Cravath, of Chicago, reported that at Lawrenceville practically all of the gasoline lighting had been displaced with tungsten lamps, and that electric lighting is used in practically all stores in the business district. This is also in competition with 30-cent natural gas.

GASOLINE COMPETITION.

Mr. David Davis, of Litchfield, gave a talk on "Gasoline Lighting." A gasoline lighting plant factory is located at Litchfield and numerous exhibition plants are maintained there by the factory. There have been perhaps one dozen explosions and one $50,000 fire as the result of gasoline lighting plants.

Mr. John G. Learned, of Chicago, reported having used "Scott's Digest" with success. Copies of this digest are sent to owners of the gasoline lighted buildings. The tenants are then seen and persuaded to put in tungsten lamps. In some towns in his territory gasoline plants have all been driven out.

Mr. C. W. King, of Lewiston, makes it a policy to purchase occasionally a gasoline plant of some user who takes electric light and advertise it extensively. He thought it safer to handle powder than gasoline.

Mr. J. T. Calloway, of Greenfield, reported having 10 or 12 gasoline plants in a town of 1500 inhabitants. He found that whenever the user kept an accurate account of the expenses of his gasoline plant, the tungsten installation had figured out cheaper at a 10-cent rate.

Mr. William H. Brown, of Peoria, reported about 400 gasoline plants in that city. He would like very much to secure a solicitor who could succeed in getting these plants out.

INTERIOR WIRING AND ILLUMINATION

Artistic Post Lighting for Omaha.

A movement for better lighting of down-town streets has begun in Omaha, Neb. One block has been equipped with handsome five-lamp iron posts having one central upright lamp and four lamps on short goosenecks. Each socket contains a 60-watt tungsten lamp. A movement is on foot among the business men to adopt this plan for lighting all of the principal business streets.

Unprotected Buried Cables in Denver Parks.

The Denver Gas & Electric Company is experimenting with unarmored lead-covered cables buried directly under the sod along the parkways of certain parks and boulevards, the cable having been used for supplying series Nernst street lamps on Cherry Creek Boulevard. Recently another circuit has been installed at the new entrance to City Park, to supply series tungsten street lamps. The cable used has a lead covering, with insulation about ¼ in. thick, consisting of 5/32-in. cambric and

BOULEVARD PARKWAY WHERE CABLES ARE BURIED.

3/32-in. rubber. The lead sheath is 1/16-in. thick. Outside of the lead sheath is one layer of treated paper and two layers of jute. On Cherry Creek Boulevard one mile of this cable has now been in service over 18 months, buried 18 in. below the surface. In some exposed places a board is laid over the cable, and in some other places fiber conduit is used for its protection. Where the cable comes up inside of the posts, connection is made to the wires, which run up the post by means of soldered joints taped with varnished cambric. This work has been done under the supervision of Mr. W. A. Carter, electrical engineer, by whose courtesy this information was furnished. The accompanying illustration shows one of the boulevard lamp posts on the parkway under which this cable is buried and gives an idea of the conditions under which this cable is being used.

Central-Station Illuminating Engineering Methods in Denver.

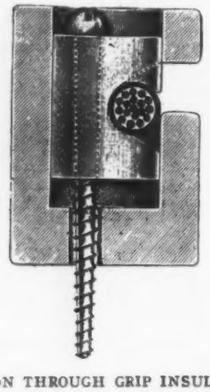
The illuminating engineering department of the Denver Gas & Electric Company, in charge of Mr. C. F. Oehlmann, has been referred to a number of times previously in these columns.

This department was established primarily for the purpose of introducing electric lighting where gasoline plants exist and satisfying complaining customers already using electric light. The general methods of this department are similar to those used in working up sign business under the supervision of Mr. George E. Williamson.

First a careful survey of the consumer's premises is made and the illumination equipment is passed upon. Draftsmen and fixture sketch artists are employed to draw up complete floor plans of the store or building to be lighted, showing the location of the outlets and the various store fixtures, tables and desks. Handsome drawings are also made of the fixtures recommended. By going into the matter thoroughly in this way, the customer is impressed with the fact that the company has been giving the matter considerable attention and that the company's engineers know what they are talking about when they approach him with the final plans. He falls under a certain sense of obligation for the attention given to his installation, and usually will accept the recommended plans. Most of the store-lighting plans now being drawn up provide for either tungsten lamps with Holophane reflectors or Westinghouse Nernst lamps. The central station keeps a stock of the tungsten lamps and reflectors and the Nernst lamp business is handled by a special representative of the Nernst Lamp Company in Denver, who keeps in close touch with the illuminating engineering department of the central station.

Insulator for Surface Wiring.

Although the tendency in this country within the past few years has been away from the cheaper classes of wiring toward the more expensive conduit installations, there has been a marked movement on foot in England and on the Continent for cheaper wiring schemes which would not necessarily embody the element of danger. It is necessary, of course, with the latter systems to use exposed wiring and to have fittings which will enable the work to be performed rapidly, so that the item of labor will not be a serious factor. The accompanying illustration shows a single grip insulator of white porcelain which is said to be used extensively in connection with these cheaper



SECTION THROUGH GRIP INSULATOR.

systems of wiring. The insulator is made up in two parts, the inner sleeve being free to move within the cylindrical shell. In using the device the cable is passed into the slots in the two parts, and these are clamped together by an ordinary wood screw, which also serves to attach the insulator securely to the wall.

The design is quite simple, and the cable is held rigidly without any danger of its insulation being damaged—the bearing surface being large and without sharp edges. As shown in the illustration, the wood screw is separated from the cable by a porcelain partition, so that even if bare wires were stretched from the insulator there would be no danger of leakage to the screw or over the surface of the porcelain, which is glazed throughout. The device has found a wide application for warehouse and factory lighting, as well as for temporary outdoor installations.

Tungstens Displace Gasoline Lamps in New York City Parks.

The Park Department of New York City has given orders to replace the present gasoline lamps in Central Park, Manhat-

FIG. 1.—POST ON RIVERSIDE DRIVE, NEW YORK.

tan and Prospect and Ft. Greene Parks, Brooklyn, by 60-watt tungsten lamps mounted on suitable standards furnished by the

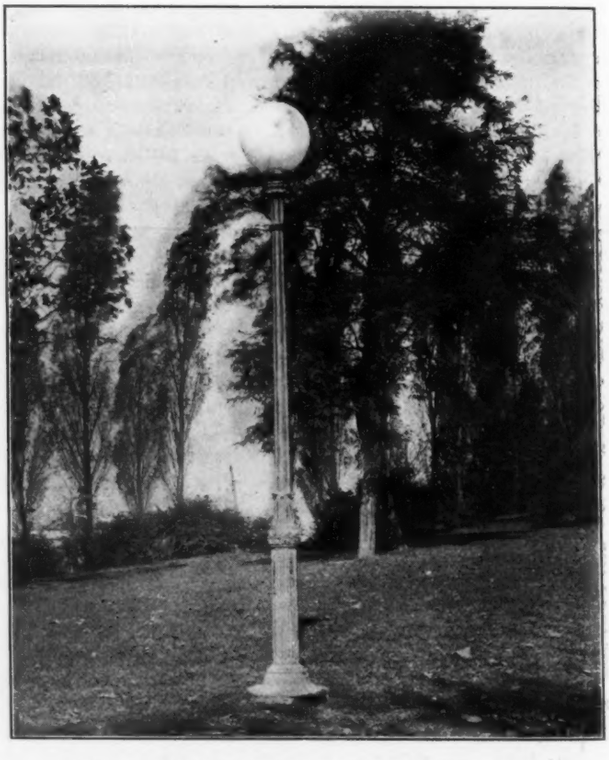


FIG. 2.—ANOTHER STYLE OF POST, RIVERSIDE DRIVE.

city. Work on all installations is now under way and it is expected that by the new year, the lighting scheme will be com-

pleted. Central Park, which now has 400 gasoline lamps, is to have 1477 electric lamps such as are at present in use on Riverside Drive and in Riverside Park. The posts themselves will be of a design sanctioned by the Municipal Art Commission and will be a great improvement over the old, not only in service but in appearance. They are constructed of cast iron with a verdi-bronze finish. Along the Mall and about the public buildings round white globes will be employed to diffuse the direct glare of the light and to add to the artistic treatment; while along the paths and roads, a clear glass globe like that used in the present form of city street lamps will be employed.

The reason for the change is three fold. In the first place, the parks have always been poorly lighted and have been in many places dangerously dark. In the second place the Welsbach gasoline lamps cause the destruction of the grass in a 3-ft. circle about every lamp-post, the gasoline used in filling the tank over each lamp being more or less inadvertently spilled or allowed to drip on the turf; this blights the sod almost instantly. In the third place, it is found that the lamplighters in going from lamp to lamp make patches across the public lawns by following the same paths evening after evening. The use of electricity will obviate all these defects.

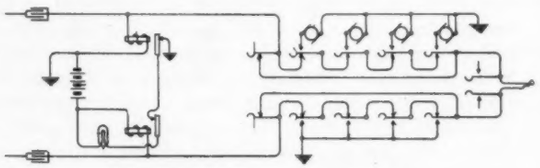
The lamps will be fed from underground armored cable placed directly in trenches dug in the soil and afterward covered over again and sodded. The circuits will be controlled in sections from a central point. The direct-current series arc lamps used around the lakes in Prospect Park will not be displaced by the tungstens and will remain as they are. These are hung from arms extending out over the lake so as to offset the effect of the trees, and are especially useful in lighting the lake during the winter when it is frozen over and given up to skaters. The New York Edison Company furnishes the energy used by the Manhattan Parks, and the Brooklyn Edison Company that used in the Borough of Brooklyn. It is expected that eventually every gasoline lamp in New York's numerous public parks will be displaced by tungsten lamps.

New Telephone Patents.

IMPROVED APPARATUS.

Whenever a ringing key is inserted in a circuit, its inner contacts being connected to open the circuit behind the point of attachment of the ringing current, a chance for trouble is introduced. When a gang-ringing key is required, however, each key, introducing contacts between itself and the key preceding, the chances for trouble from a faulty contact are greatly multiplied. To obviate this difficulty there were introduced special gang keys wherein a single cut-off key served to do the circuit opening for all the ringing contact keys, it being necessary, of course, to so arrange the parts that the cut-off key responds to the depression of any of the ringing contact keys.

Mr. C. A. Simpson, of Chicago, Ill., has now come forward with an improvement upon this scheme, by so arranging his gang key that there are two sets of cut-off contacts in parallel



SIMPSON RINGING-KEY CIRCUITS.

arrangement, so that both branches of the circuit must fail at the same time to cause trouble. Fig. 1 shows the circuit through the key, it being understood that the mechanical arrangement of parts is the usual one, viz.: a rocking bar which serves as a latch to the last, depressed push, and which also, in giving away before the plunger, serves to actuate the auxiliary or cut-off key. In the figure this latter is the key to the extreme left. The Kellogg Switchboard & Supply Company has been assigned Mr. Simpson's patent.

In ordinary commercial telephone working it usually suffices to determine upon a satisfactory efficiency for the receiver and then to maintain this constant not only for each individual instrument, but for all instruments. For the audiphone, with its over-excited receiver, it is necessary to adjust the operating efficiency to the particular state of hearing of the user. A very simple way to accomplish this has been devised by Mr. C. E. Williams, of Natick, Mass., which is simply a magnetic shunt about the diaphragm. Suppose the pole pieces elongated beyond the receiver coils sufficiently to be drilled. An iron cylinder is inserted in the drilling in one pole, the other not being drilled, and a screw device, which can be operated from without the receiver shell, serves to drive the cylinder forward and back as desired, thus providing an adjustable magnetic shunt about the diaphragm. It will be seen that the receiver is thus adjustable from nothing to its maximum efficiency.

Most receiver-supporting arms have been invented as auxiliary attachments for telephones, but recently there has been a tendency toward making them an integral part of the set, and several patents recently have described arms of this type. The latest is an arm patented by Mr. Henry Eccles, of Laclede, Mo. This arm attaches to the usual transmitter-supporting arm between the arm proper and the transmitter case. The receiver arm is hollow and projects at right angles to the transmitter arm for a short distance, where it turns at right angles and extends forward so that the receiver at its end is at a proper position for the ear. At the elbow or right angle is a hinge, the forward arm swinging horizontally thereon a few degrees between stops. A spring impels the arm inward and the ear of the user impels it outward. Within the arm, which is hollow, are the switch springs which control the circuits and the arm in its positions controls the arrangement of the circuit.

Mr. L. H. Webster, of Belvidere, N. Y., has obtained a patent for what he calls a telephone guard—viz., a wire device to be clamped to a transmitter mouthpiece to receive the lips of the user and thus serve as a gage for distance, preventing contact with the mouthpiece, yet encouraging close proximity. An antiseptic device is the subject of a patent granted to Mr. F. Schilling, of Nuremberg, Germany. He does away with the ordinary transmitter mouthpiece and substitutes therefor a sheet-metal mouthpiece, the wide end of which is closed. That is to say, the mouthpiece is bottle shaped, the neck attached to the transmitter and the flat bottom toward the user. This bottom serves as an auxiliary diaphragm. It may be readily kept clean by wiping.

STEP-BY-STEP PARTY-LINE APPARATUS.

A sending apparatus for a step-by-step system forms the subject of a patent granted to Mr. Nils Norstrom, of Chicago, Ill., and assigned to the Anderson Electrical Manufacturing Company. This apparatus is provided with a separate lever for each number to be sent. When the lever for any number is actuated, the motor spring of the contact-maker is wound and this proceeds to send out a series of makes and breaks. This causes all stepping devices at the several stations to advance synchronously. The selection of any one of these depends upon the sending of an extra impulse when the stepping devices have advanced to the point corresponding to that station, as each is adjusted to a different distance. Each lever provides for sending this auxiliary impulse for the station with the number of which it corresponds.

Mr. W. W. Hill, of Sumter, Minn., has also obtained a patent for a step-by-step system. In this system a spring-driven motor actuates the make-and-break arm whenever its latch is sprung. Each station corresponds to its own angular distance from normal and the calling keys are spaced similarly.

The patent granted to Mr. R. Hamilton, of Boston, Mass., relates to improvements in a previously patented system. The controlling or operating magnets of the various stations are in the main circuit, and shunts are provided about these to improve the transmission. The circuit is normally open, so that there is no loss of current when not in use. Two break-wheels are used. One steps the instruments up to selection, and the

second steps all home to zero automatically as soon as the connection is no longer desired.

SWITCHBOARD CIRCUITS.

With the magneto system there have been numerous suggestions to do away with the hand generators at the stations, using instead a momentary contact during the transition of the switch-hook. Usually there has been a battery or direct-current generator connected to the circuits in a manner such that this contact completes a ground connection to operate the drops. Mr. F. C. Unger, of St. Louis, has substituted an alternating generator with a condenser in its ground connection and has patented such a system. Offhand, it would seem that this generator would cause noise, as it remains connected throughout conversation, although through heavy retardation, which operates differently to the ground connection and cumulative to the talking circuit.

The usual operation of trunking on the calling circuit basis involves one-way trunks and is a separate group of trunks for business in each direction. These groups may be combined, if each trunk is equipped at both ends with both types of terminal, the one first used protecting the trunk from use at the other. In other words, if a trunk is picked up "incoming" at one exchange, it must be protected against assignment as "incoming" at the other. In order to accomplish this Mr. C. A. Simpson has arranged a signal at each incoming terminal, its lamp glowing to guard the trunk whenever it is in use at its outgoing terminal in its own exchange. He has assigned his patent to the Kellogg Company.

Letters to the Editor.

Norwegian 170,000-kva Nitrogen Plant.

To the Editor of Electrical World:

Sir:—Under the heading "Atmospheric Nitrogen" in your issue of Oct. 14 it is stated that the order for generators for the Rjukanfos nitrogen fixation plant was given to a Swiss firm, which statement is not quite correct. Our firm, the Allmänna Svenska Elektriska Aktiebolaget, received an order for five three-phase generators, 17,000 kva, 11,000 volts, 250 r.p.m., for this plant at the same time that five similar machines were ordered from Brown, Boveri & Company. The above-named generators are now being built in our works at Westeras, Sweden, after our own design.

Allmänna Svenska Elektriska Aktiebolaget.
Westeras, Sweden.

Some Errors in Testing Sources of Light.

To the Editor of Electrical World:

Sir:—I have read with much interest the editorial on "Some Errors in Testing Sources of Light" in the issue of Oct. 14, and also the letters relative to this editorial in the subsequent issues of Oct. 21 and Nov. 11. Although I should not desire to be misunderstood as attempting to give a complete statement of the problem, which would be a very difficult task and entirely unsuited for presentation either in an editorial or in a letter to an editor, I should like to add a few words to the discussion which, in my judgment, has wandered considerably from the apparent intent of the editorial.

It would seem to me that the editorial was meant to be a practical statement to practical men of some of the errors involved in testing practical sources of light, and to this extent was very pertinent in the light of some recent attempts to investigate mathematically the distribution of light from extended sources. In the last analysis all practical luminous sources must be divided into *surface* and *volume* sources, since we cannot conceive of *material lines* or *points*, and all practical sources, whether primary or secondary, consist of *matter* radiating or reflecting luminous energy. As a matter of fact, if we view radiating surfaces as was done by Fourier, Poisson, Zöllner, Lommel, and others, even so-called *surface* sources are reduced to *volume* sources in which the emitted energy comes from the elements of volume lying to a greater or less distance beneath the surface.

In cases, however, where the capacity is such that practically all of the energy emitted comes from those elements lying quite close to the surface, the distribution around an infinitesimal element of surface follows approximately the cosine law. This is the case in practically all radiating solids, and the character of the radiation, following approximately the cosine law, is so distinct from the radiation from unsaturated luminous gases, as in the case of the Moore tube or the mercury vapor tube, that it would seem expedient to distinguish *surface* sources from *volume* sources, as is done in the editorial.

It has been the general custom, and until within a few years ago, the almost universal custom, to consider all practical luminous sources as points to which the law of the inverse square of the distance applies. Although in reality there are no real *point* sources, this convention is, in my judgment, quite permissible in many cases, since the resultant errors are negligible. As new sources having relatively large dimensions have been introduced, and as new interest has been aroused in the consideration of such secondary sources as diffusing skylights, it becomes necessary to keep in mind the limitations of the inverse square law. I think, therefore, that the editorial is very much to the point in dividing practical luminous sources into those which may, for practical purposes, be considered as points, and those which, even for practical purposes, may not be considered as points, subdividing the latter into those which must be considered as *surface* sources—i.e., those to which the cosine law applies approximately and those which must be considered as *volume* sources—i.e., those to which the cosine law does not apply even approximately.

Although I appreciate the point which Mr. Hering has raised in reference to including *line* sources, I am inclined to think that, from a practical standpoint, the inclusion of *line* sources would complicate rather than simplify the classification. As stated above, there are no real *line* sources, and it is impossible to conceive that there ever can be any material sources which would have the characteristics of a geometrical line. In every case the source will be either a *volume* source or a *surface* source, and it will be necessary, in calculating the distribution, to determine whether the source is an unsaturated radiating gas or whether it is a radiating surface. Moreover, if a surface, it will be necessary to know whether it is a long slender strip or a long cylinder of small diameter, for the distribution will be different in the different cases. It does not seem to me desirable therefore in a practical classification to lay any emphasis on *line* sources, since in all practical consideration of such sources it will be necessary to analyze them further into *volume* or *surface* sources.

There is one word that I should like to add regarding the letter from Mr. Bassett Jones, which deals more with generalizations regarding the relation of physics to mathematics than with the specific point in question. I shudder at the thought of assuming the responsibility of urging publicly a lack of rigor in mathematical treatment of physical problems. Far more serious consequences result from inexact mathematics than from unwarranted rigor. Master minds, such as those mentioned by Mr. Jones (Maxwell and Heaviside), recognize the limitations of natural phenomena and mathematical analysis and might with least chance of error bridge the gaps in analysis with scientific intuition.

Mr. Jones would take exception to the usage of the term "application of mathematics to physics," but it would seem to me that the basis of criticism comes from a self-imposed idea of the meaning of the phrase. Mathematics, it is true, is frequently applied as thick coats of "green" paint that entirely hide the object coated and might deceive the less careful observer as to the true nature of the hidden substance. But I am inclined to think that even a moderately competent person

would be quite able to ascribe the "greenness" to the paint, and would not mistake the painted object for *real* mathematics, which has been called by Carlyle, "the greenest of all vegetables," and has hence been depicted by Maxwell as a cabbage. Mathematics *should* be applied to physics as a chisel to a piece of marble, which adds nothing, but by the process of elimination, uncovers an otherwise hidden face or figure.

CLEVELAND, OHIO. EDW. P. HYDE.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Magnetic Flux in Air.—T. LEHMANN.—For the determination of magnetic stray fluxes the distribution of the lines of magnetic flux in air is of fundamental importance. The author describes an exact graphical method for plotting the lines of magnetic flux in air-gaps. His method is based on subdividing the air-gap into tubes of magnetic lines with unity reluctance so that the mean length of each tube equals the mean cross-section. Various examples are given to illustrate the method.—*Elek. Zeit.*, Oct. 21 and 28. The first part of the article also in *La Lumière Elec.*, Oct. 23.

Iron Losses in Elliptic Rotary Fields.—E. ROTHER.—Since the introduction of single-phase commutator motors which are operated partly with alternating fields and partly with elliptic rotary fields, the problem of determining the iron losses in such fields has increased in importance. The author describes a method of measuring the iron losses in elliptic rotary fields. After a general discussion of the changes of magnetism in elliptic rotary fields and in its special cases (the circular rotary field and the alternating field) he gives the loss of the change of magnetism of an iron particle rotating in such fields. On the basis of the results of measurements the author describes a method of calculating the iron losses in elliptic rotary fields. In conclusion, he compares and discusses his results with formulas and measurements of the iron loss in pure alternating fields.—*Elek. und Masch.* (Vienna), Oct. 17 and 24.

Starting Induction Motors.—C. REY.—A mathematical study, illustrated by diagrams, of the rôle which the higher harmonics played in the starting of squirrel-cage induction motors.—*L'Industrie Elec.*, Oct. 25.

Lamps and Lighting.

Metallic-Filament Lamps.—BLONDEL.—A review of the present status of metallic-filament lamp manufacture. The author distinguishes two different methods of manufacture. The first is a direct method in which the filament is made directly from the desired metal or its compounds. Tantalum may be drawn into wire in pure metallic state. One company claims that filaments of molybdenum and tungsten, with a small amount of carbon, can be drawn; the carbon is to be removed afterward. Singer claims that an addition of 1 per cent of aluminum (which has otherwise no bad effect) makes metals ductile which otherwise could not be drawn into wire. This method, however, has proved successful so far only with tantalum. In other direct methods the filaments are pressed from a plastic paste and then sintered together. The most general method is the manufacture of compressed filaments from mixtures of the metal and its oxide and a binding material. When finished these filaments must be reduced and decarbonized. The second general class of methods comprises the indirect methods in which the filament produced is not homogeneous. The metal may be deposited, for instance, on a carbon core, the core being afterward removed. This method has been employed for thorium, zirconium and tungsten, also for the preparation of a composite filament of tungsten with a tantalum core. The specific watt consumption of this filament is stated to be between that of the pure tungsen and that of the pure tantalum filaments. The ratio of the initial current when the circuit is closed and the current when the lamp is in regular operation is between 0.7 and 0.54 for carbon lamps, between 4.6 and 4.9 for tantalum lamps, and 7.3 for tungsten lamps. With alternating current the metallic-filament lamps show oscillations of the candle-power. These are greater for 25 cycles than for 50 cycles, and amount to 37 per cent with tungsten lamps at 25 cycles and 17 per cent at 50 cycles. Tantalum filaments suffer from these oscillations and they are, therefore, unsuitable for alternating current. The curves giving the distribution of light of metallic-filament lamps follow almost exactly the law of Lambert, according to which $J\alpha = J_h \cos \alpha$, where α is the angle with the horizontal plane. Most light is, therefore, radiated in the horizontal direction. The ratio of the mean spherical candle-power to the horizontal candle-power varies between 0.6 and 0.9; this coefficient increases with the number of hours for which the lamp is used. It is recommended to use 110 volts instead of 220 volts as the supply e.m.f. for new direct-current stations. With the present condition of incandescent-lamp manufacture the cost of energy at 220 volts would have to be 25 per cent less than at 110 volts in order to get the same cost of illumination in the two cases. In alternating-current plants, the voltage is of less account since small transformers can be used advantageously.—*Bull. de la Soc. Int. des Elec.*, Vol. 9, 1909, page 79; abstracted in *Elek. Zeit.*, Oct. 28.

Metallic-Filament Lamps.—B. DUSCHNITZ.—The first part of a serial on the latest processes for making metallic filaments. The article seems to be based chiefly on patent specifications of the last year. No further suggestion has been made during the last year on the manufacture of filaments directly from the oxides of pure rare earths. Various propositions have been made, however, for making filaments with the aid of organic substances and binding materials. The manufacture of metals in colloidal state or from paste has been further developed. Most interest is taken at present in the addition of easily fusible metals to refractory metals in order to permit a good sintering of the refractory material. The intention is chiefly to produce filaments directly from the powdered metal by pressing, drawing or rolling. In the present instalments the author describes the latest method of making filaments with the air of organic substances, and the latest methods of making filaments by wet methods, either with the aid of colloids or the production of filaments from liquid metallic compounds.—*Elek. Anz.*, Oct. 17 and 28.

Train Lighting.—An illustrated article on the train-lighting system of Brown, Boveri & Company. Each car is lighted independently by means of a shunt-wound generator driven by an axle of the car and joined in parallel with a storage battery. A regulating apparatus operates in such a way that the lamps are always supplied with current at the correct voltage and that the battery is being regularly charged and discharged without being overloaded. The article deals especially with some recent improvements in the regulating apparatus.—*Elek. Anz.*, Oct. 21.

Illumination of Rooms.—An article, illustrated by diagrams, on the economy of electric illumination of rooms by means of incandescent lamps.—*Elek. Anz.*, Oct. 24.

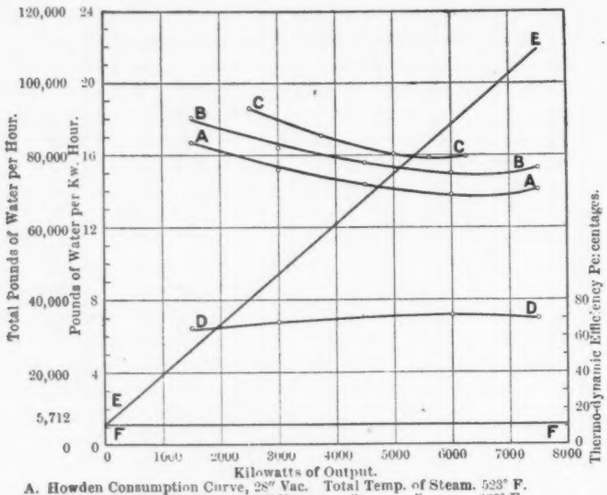
Generation, Transmission and Distribution.

Transmission System in Southern France.—An illustrated description, with a map, of the very extended energy transmission system of the Société d'Energie Electrique du Littoral Méditerranean. It comprises 19 generating stations with an aggregate of 91,800 kw in water-power and 22,000 kw in steam-power as reserve. Some notes are given on the voltages, which range from 50,000 to 10,000, the frequencies (25 or 50), etc. The company supplies energy chiefly in bulk. It supplies energy to 10 tramway systems and 16 companies for local distribution of the energy. Among the latter is the Sud Electric Company, which supplies energy over a district having 400,000 inhabitants. —*Elek. Zeit.*, Oct. 28.

Electric Operation in Collieries.—W. H. Patchell.—The first part of an illustrated article on the electrification of the Ferndale Collieries, in South Wales. A description is first given of the generating station and the distribution system, after which the author proceeds to describe the various applications of electric motors. These include electrically driven fans, haulage, pumps and winding equipments. The paper is to be continued.—Lond. *Electrician,* Oct. 29.

Steam Condensers.—F. Hodgkinson.—The conclusion of his long illustrated serial on the choice of a steam condenser. While the author thinks that every case is to be considered on its own merits, he gives the following general governing rules: "Do not use a surface condenser unless condensed steam must be returned to the boilers and it is sure to be a paying investment, remembering that in the surface condenser the cooling medium does not intimately mix with the steam. Choose a plain jet or centrifugal condenser rather than barometric unless the advantages in the particular layout in favor of the barometric are very certain."—*Elec. Journal,* November.

Steam-Turbine Set.—An illustrated description and account of tests of a new 6000-kw Howden (Zoelly)-Siemens turbo-generator at the Manchester electric station. Its steam consumption is even less than the very low figures obtained with the Willans-Siemens 5000-kw set at Stuart Street last year. A record of these tests is given in Fig. 1, which shows the steam consumption of the new and old sets, the results being corrected so as to be comparable. It is seen that the extremely low figure of 13.8 lb. per kw-hour was obtained at full load with a 28-in. vacuum and 140 deg. Fahr. of superheat, and the results at quarter-load are also excellent. The construction of the Zoelly turbine is described and illustrated.—Lond. *Elec. Eng'ing,* Oct. 28.



A. Howden Consumption Curve, 28″ Vac. Total Temp. of Steam. 523° F.
B. " " " 27″ Vac. " " 483° F.
C. Willans-Siemens (5000 Kw. Turbine. 6000 Kw. Alternator.) 27″ Vac. Total Temp. of Steam, 483° F.
D. Howden Thermo-dynamic Efficiency Curve.
E. " Total Water Consumption.
F. " No Load Consumption.

FIG. I.—STEAM CONSUMPTION CURVES.

Steam Turbine.—J. Reyval.—In an article on the International Electrical Exhibition, in Nancy, the author describes the exhibit of the Electra steam turbine. The problem caused by the excessive speed of steam turbines has been attacked in different ways; for instance, by the division of the speed into several stages, as in the Curtis turbine, or by the subdivision of the pressure as in the Rateau and Zoelly turbines. Both of these methods are combined in the Electra turbine.—*La Lumière Elec.,* Oct. 23.

Steam Turbines in Mining and Metallurgy.—A. P. Chalkley.—An illustrated article in which the author considers the very large economies to be effected by installing exhaust-steam turbines in collieries, rolling mills and other situations, particularly where reciprocating engines are working under favorable conditions.—Lond. *Electrician,* Oct. 29.

Baltimore Power Plant.—H. A. Foster.—A Franklin Institute paper on "power-house economics in Baltimore." The author gives a review of the complete reorganization of the system supplying energy to the Baltimore tramways.—*Jour. Franklin Inst.,* November.

Water Supply and Power.—B. A. Heinly.—An illustrated article on the plan, construction and purposes of the Los Angeles aqueduct, which is a combined water supply, irrigation and power project.—*Eng. Mag.,* November.

Traction.

London Tramways and Tramway Fares.—Statistical notes on the financial returns of the London Council Tramways during the past year. The total length of the tramways is 127.6 miles, of which 76 miles are on the electric underground-conduit system and 9.5 miles on the overhead trolley system, and the remainder is horse traction. In an editorial note it is pointed out that the most striking feature of the statistics is the decrease, during the past year, of nearly 17,000,000 in the number of passengers paying 2-cent fares. At the same time the number of 1-cent tickets issued shows an increase of about 13,000,000, while the number of passengers paying 3-cent and 4-cent fares also shows increases of about 5,000,000 and 17,000,000, respectively. From these figures, and also others showing the rapid growth during recent years in the number of passengers paying 1-cent fares, it is evident that the question of fares should receive the careful consideration of the Council. It is thought that the tramway fares need also reconsideration in the United States. In England the 2-cent fare has been the mainstay of most tramway systems, and efforts have usually been directed to increasing, as far as possible, the facilities afforded to "penny" (2-cent) passengers. It is obvious, however, that where 1-cent fares are in vogue this policy must be considerably curtailed.—Lond. *Electrician,* Oct. 29.

Multiple-Unit Control.—L. M. Aspinwall.—An illustrated description of the multiple-unit cars of the New Haven railroad.—*Elec. Journal,* November.

Installations, Systems and Appliances.

Electrical Industries in the United States and Germany.—W. Fellenberg.—The conclusion of his article. The author discusses the use of electricity for industrial purposes and claims that in this respect Germany has made the greatest progress not only by the widest introduction of electricity in mines, metallurgical works, rolling mills and in agriculture, but also by insisting at an early date on the superiority of individual motor-drive over group-drive in many industrial works. It is claimed that in this respect the development has been more rapid in Germany than in the United States. On the other hand, it is stated that from 1890 to 1905 the use of electricity for energy transmission in the industries of the United States has increased from 15,569 hp to 1,592,483 hp, and has, therefore, increased by more than 10,000 per cent within 15 years. This is said to be the most rapid development of any invention on record. The author then gives a review of the use of electricity on board ship and, finally, some notes on water-powers. He thinks it is a conservative estimate to assume for Europe and the United States an average of 6 hp per square km (about 16 hp per square mile). He estimates that about 60,000,000 hp could be made available in Europe, and 120,000,000 hp in the United States and Canada.—*Elek. Zeit.,* Oct. 28.

Development of Electric Supply Stations in England.—S. J. Watson.—A review of the development of electric supply stations in England during the past 15 years. The amount of capital invested has increased from 4,000,000 to nearly 60,000,000 of money in 15 years. In the case of the author's own undertaking, for example, during the last seven years the output has increased nearly tenfold, and large extensions had been carried out. The extra generating costs amounted to 0.586 cent per kw-hour, the extra capital charges on plant to 0.308 cent, the extra distributing costs to 0.468 cent and the extra management charges to 0.174 cent, so that the total additional cost of supplying the extra units amounted to 1.536 cent per kw-hour. The

load factor of the increased output had been 23.3 per cent. The average capital cost per kilowatt of plant and mains installed had decreased from $695 in 1894 to $360 in 1909; the number of units sold per $5 of capital invested had increased from 3.4 to 14.2; the average price charged had been reduced from 12.32 cents to 4.32 cents per kw-hour, and the gross profit had gone up from 3.3 per cent to 6.6 per cent. Also, whereas the cost of the plant and mains added during the period from 1894 to 1899 was $460 per kilowatt, the cost of the additions during the period from 1904 to 1909 was only $285 per kilowatt; and the additional working expense for the increase in the output between 1894 and 1899 was 4.26 cents per kw-hour, while the cost for the increase in output between 1904 and 1909 was only 1.36 cents per kw-hour. He pointed out that there was a difference of 293,095 kw between the total rating of the plant installed and the maximum load recorded—that is to say, that no less than 37 per cent of the total plant was provided as reserve. This represented a capital expenditure of over $6,000,000 which was entirely unproductive, a figure which, he thought, could have been considerably diminished by the more general adoption of interconnection. The reductions in average cost per kw-hour were due to a variety of causes, not the least among which had been the increase in the size of generating sets. The author discusses at some length the subject of steam turbines, and thinks it is a sign of the times that the impulse machine is being used to an increasing extent in the large sizes. The tendency of turbine construction is to increase the clearances, reduce the number of stages and to shorten the length between bearings, and progress along these lines is likely to be more successful with the impulse than with the reaction turbine. Speaking generally of rates for energy supply he expressed the view that the figure of 0.6 cent per kw-hour sometimes given as the price above which it would not pay a manufacturer in Lancashire to enter into a contract for a supply of energy was too low. Many large manufacturing concerns have found it remunerative in the long run to purchase from outside sources at prices varying between 1.5 cent and 1 cent per kw-hour, and such a price is quite sufficient to enable the most of the larger undertakings to maintain and even improve their financial position, as with the excess of the motor load at these low prices the working expenses per unit are very largely reduced.—Lond. *Elec.*, Oct. 29, and Lond. *Elec. Eng'ing*, Oct. 28.

British Station.—An illustrated description of the newly opened Blyth's Wharf generating station of the Stepney Borough Council. The reinforced-concrete building contains one 1000-kw double-current turbo set, which was moved from the old station, and a new 2000-kw turbo-alternator. A feature of the station is the 6000-volt switchboard on the Reyrolle ironclad system, and the use of the Merz-Price protective system throughout. Continuous current at 2×240 volts is provided for, as well as a high-tension supply.—Lond. *Electrician*, Oct. 29, and Lond. *Elec. Eng'ing*, Oct. 28.

Parallel Operation of Series Machines.—H. L. BEACH.—A description of the difficulties in the parallel operation of

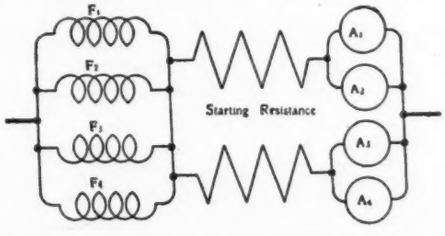


FIG. 2.—FOUR SERIES MOTORS IN PARALLEL.

machines with series-field coils. He first discusses series-wound and compound-wound generators. When two or more series-wound or compound-wound generators are operated in parallel it is necessary to use an equalizer between the various machines. The object of this connection is to maintain the desired equilibrium of loads between the generators in parallel under all conditions. In some cases the equalizer is in the form of a low-resistance cable running directly from machine to machine; in others it is desirable to have an equalizer bus-bar on a switchboard. The adjustment of the series-wound machines is far more difficult than that of the compound-wound machines. If the two machines in question are located so that the leads from one machine to the switchboard are twice as long as the corresponding leads of the other machine, resistances must be added to the leads to the latter

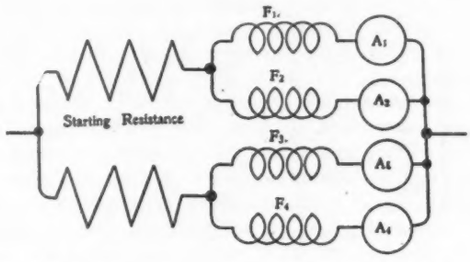


FIG. 3.—FOUR SERIES MOTORS IN PARALLEL.

machine so as to make its field-circuit resistance exactly equal to that of the other machine. To divide their load properly, it is necessary that the series-wound generators be at the same temperature when adjustments are made. The author then takes up the parallel connection of series-wound and compound-wound motors. He deals with the case in which four motors of about the size of the ordinary street-car motors were geared permanently to the load, the control apparatus being simplified by connecting the four field coils in parallel. The connections were essentially as shown in Fig. 2. Thus far the apparatus has been working very well, but careful field-circuit adjustments are necessary, which, in practice, are not always practicable. Should a field coil become partially open-circuited on any motor, the weakened field would cause the armature at once to take all the load and unless the trouble was discovered at once, the armature would burn out. Suppose that a field-circuit lead becomes broken, for example, F_1, armature A_1 would take all the current in its part of the circuit, since it would generate no counter e.m.f. The other pairs of motors, 3 and 4, would run the machine, and armature A_2, being in a strong field, would pass current through armature A_1, acting as a short-circuit on No. 2, thus giving rise to an excessive current. If there were no circuit-breakers or fuses in this current, armature A_1 would, of course, be burned out. In this case, if the field coils were separated from each other and reversed separately, the opening of a field-circuit could do no harm, since the corresponding armature would be open-circuited at the same time. This scheme of connection, which is shown in Fig. 3, is considered a safe and more correct method for the parallel operation of four series-wound motors. In paralleling any two compound-wound motors it is only necessary to have the speed regulation exactly alike to make them divide the load properly. With single-phase commutator motors another factor enters into the problem which tends to reduce the necessity of resistance equalization. This is the inductance of the field coils, which is of such a constant and reliable value that the field-coil resistance can be practically neglected. Thus the motors on the cars and locomotives on the New Haven railroad have their field coils connected in parallel pairs when running on alternating current.—*Elec. Journal*, November.

Regulation of Power Factor.—A note on a recent British patent 25,556, Oct. 21, 1909) of the British Thomson-Houston Company (General Electric Company of this country). The excitation of a synchronous motor taking a leading current and thus improving the power factor of an alternating-current system, is automatically regulated by means of a Tirrill regulator having, in place of the usual alternating-current control magnet, a solenoid with two windings receiving energy through a series transformer. The floating coil is mounted on a rod joining the cores of the two shunt windings, and the effect of

the arrangement is to hasten or retard the time of the closing of the main control contacts in accordance with fluctuations in the power factor so as to vary the field excitation of the synchronous motor.—Lond. *Elec. Eng'ing,* Oct. 28.

Recording Meters for Motor Installations.—A. G. Popcke.—An article in which the author endeavors to show how a study of existing conditions can be made by automatically recording the operations of industrial plants by the use of graphic electric meters, and that by such a study valuable information may be obtained as to the best methods of economizing in operating expenses and improving equipment. In investigating the economy of motor drive too much stress is often laid upon the cost of energy. The three important items to be considered in determining the relative advantages of different means of equipment are: first, the total hourly operating cost; second, the percentage of the total time consumed in actual work; third, the rate at which an equipment is operating while actually running. For a given equipment the first item can be determined from the wages of its operators and the overhead operating cost. The second is a direct check upon the number of delays and requires personal observations and clerical records, thus increasing the overhead charges, unless there is some means of using an automatic recording device. Where individual motors are employed, this percentage may be determined directly from the records obtained by means of graphic meters, since these show all idle and no-load intervals. The third item is a direct check upon whether or not the rate of output is the maximum under the given conditions; determined in most cases by the mechanical strength of the parts operating, the accuracy of the workmanship required and other local conditions. With individual motor drive and the graphic meter, the magnitude of the records obtained in many cases indicates at a glance the rate of working.—*Elec. Journal,* November.

Electric Cables in Collieries.—W. R. Morton.—An article on the selection and installation of electric cables in collieries. In speaking first of shaft cables, the author compares the advantages of paper-insulated lead-covered cables, paper-insulated cables sheathed with vulcanized bitumen, and vulcanized bitumen cables. He explains that for shaft cables carrying ordinary motor loads at e.m.fs. up to and including 3000 volts he recommends the use of double-wire armored solid bitumen three-core cables, with the strands "filled" for three-phase work, and double-wire armored single bitumen cables strand filled for direct-current work. With respect to underground distributor cables the question is whether to use armored or unarmored cables. Armored cables are less liable to damage when properly installed, and if the armor is properly grounded and bonded they provide a ready and sufficient means of grounding the motors, etc., and far-distant points. Various rules are then given on the laying of cables on the surfaces, in shafts and underground and on the joining of cables.—Lond. *Electrician,* Oct. 29.

Metal Sheathing of Insulated Wires.—A note on a recent British patent (24,348, Oct. 21, 1909) of J. J. Rawlings, H. W. Handcock and A. H. Dykes. Hard-metal sheathing comprising a metal strip with the two edges overlapped and soldered is liable to buckle. According to this invention a tinned metal strip is wrapped at least twice round the insulated conductor, so that the finishing edge lies parallel along the commencing edge. A set is put in the strip so that the finishing edge does not project above the even surface of the sheathing, and the joint is treated with soft solder. The folded strip is drawn through a heated die, the conductor being drawn in at the same time. The previous tinning of the sheath causes it to become solid and equivalent to a solid-drawn sheath.—Lond. *Elec. Eng'ing,* Oct. 28.

Calculation of Transmission-Line Regulation.—A. Blondel and C. LeRoy.—A continuation of their paper on the calculation of transmission lines for alternating currents, taking into account the distributed capacity and leakage. The method is essentially a graphical one. In the present installment the authors illustrate the method by the numerical calculation of an overhead line for a transmission of 20,000 kva of three-phase currents over a distance of 1200 km (720 miles) at a tension of 120,000 volts with a frequency of 25 cycles.—*La Lumière Elec.,* Oct. 23.

Electrophysics and Magnetism.

Beta Rays of Radium.—O. Hahn and L. Meitner.—It has so far been assumed that the beta rays of radium have their origin in radium B and radium C and radium E_2. The authors show, however, that radium itself gives typical beta rays, which, on account of their high penetrative power, can be distinguished with certainty from the other beta radiations. The authors have advanced the working hypothesis that complex rays are due to complex substances and they now conclude from the existence of this beta radiation of radium that radium itself must be a complex substance.—*Phys. Zeit.,* Nov. 1.

Electrochemistry and Batteries.

Electrolytic Hypochlorite as Disinfectant.—The report of the public health committee of the Poplar Borough Council, in England, on the working of the electrolytic plant during the past summer shows that the demand for the fluid could not be fully met, although the plant was worked overtime. The stability of the fluid during the hot weather was found to be very good. The total output for the year to the end of August was 17,794 gal.; during August the output was 4326 gal. The cost per gallon was slightly over 1 cent for the materials and electricity (3 cents per kw-hour). The plant is in good order and extensions are under consideration with a view to meeting the increased demand. By far the largest item of cost is that of wages, mainly incurred in bottling and issuing the fluid, and amounted to $2,080 for five men (apparently from January to August, 1909, inclusive). This, on the basis of 18,000 gal., means over 10 cents a gallon issued, and including sundry expenses the total cost appears to be about 12 cents per gallon. The works department is supplied, however, at 2 cents a gallon. The hypochlorite has also been used for disinfecting and deodorizing the water in public swimming baths, using only a comparatively small quantity of hypochlorite, namely, about 40 gal. to a bath of 75,000 gal. on the first day and 20 gal. the day afterward, the same water being used for three or four days. It was found that the water remained unpolluted for several days when thus treated, and the bathers expressed their appreciation of the improvement.—Lond. *Elec. Review,* Oct. 29.

Units, Measurements and Instruments.

Meters for Rectified Current.—P. MacGahan.—In view of the extensive use of rectified currents for illumination, for battery charging and other purposes, the question of proper meters to use in measuring these currents is one of considerable importance. A rectified current is a superposition of alternating current on direct current. There are two different types of indicating meters available. First, those meters in which the torque is proportional to the first power of the current—that is, permanent-magnet moving-coil meters designated as operating on the D'Arsonval principle; second, those meters

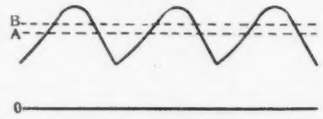


Fig. 4.—Characteristic wave-form of current in rectified circuit.

in which the torque is proportional to the square of the current, such as the hot-wire meters, the dynamometer meters, which have a coil moving in the field of the stationary coil and a movable iron needle or vane which actuates the pointer. The first type measures the average mean current, which is equal to the value of a constant current having the same chemical effect, as in charging storage batteries. This is indicated by the dotted line *A,* in Fig. 4. The second type of meter measures the square root of the mean square value of the current. It

is indicated by the dotted line *B* in the illustration. If a meter of the first and one of the second are connected in series in a rectified-current circuit their indications will differ according to the relation which the ripple bears to the total current and the form factor. This discrepancy may be in the neighborhood of from 2 per cent to 5 per cent under commercial operating conditions, as shown by actual tests. Alternating-current ammeters operating on the induction principle will measure with accuracy the square root of the mean square or effective value of the ripple only, and will not be affected by the main portion of the rectified current.—*Elec. Journal,* November.

Telegraphy, Telephony and Signals.

Detector for Wireless Telegraphy.—A description of a new form of magnetic detector invented by A. G. Rossi and based on the fact, discovered by Prof. A. Sella in 1903, that the magnetic state of iron is sensitive to electromagnetic waves when the hysteretic cycle is due to elastic deformations. A fine iron wire, 0.03 mm in diameter, is stretched between two points,

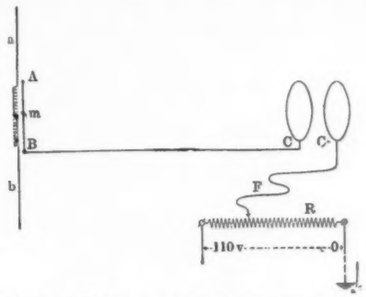


FIG. 5.—DIAGRAM OF DETECTOR CIRCUITS.

A and *B* (Fig. 5), and is magnetized with a pole in the middle by means of two bar magnets fixed parallel to it, their like poles being adjacent. An oscillograph mirror *m* is attached to the wire at its middle point and reflects a beam of light from a Nernst lamp and slit onto a galvanometer scale. In consequence of the Wiedemann phenomenon an alternating current in the wire will set up torsional oscillations, whose amplitude will be the greatest when the frequency of the current is the same as that of the free vibrations of the wire, producing on the screen a horizontal band of light. To provide this current one end of the wire was connected to a plate *C* of an air condenser *CC'*, the other end remaining free. The plate *C'* was connected to the sliding contact of a rheostat, *R*, which had 110-volt, 42-cycle alternating-current impressed across its terminals, one of which was grounded. The small capacity current surging in and out of the condenser was found to be quite sufficient to set up torsional oscillations of considerable amplitude, which could be varied by moving the sliding contact. The iron wire is inclosed in a small glass tube, which is wound with a magnetizing coil *a b;* this coil is divided into two equal parts which are arranged in opposition—like the bar magnets—and is connected with one end to the air wire and the other to earth. Atmospheric discharges produce no visible effect. However, for a series of sparks in rapid succession, especially if its frequency is the same as that of the wire, the instrument is very sensitive. Used in this manner it is necessary to have at both the winding and receiving stations a source of alternating current of definite frequency to which the wire can be tuned, and which feeds the spark-gap of the sending apparatus, thus producing the proper frequency of wave trains. Later experiments have shown that it is not necessary to supply the wire with an alternating current in order to use it as a detector. A series of strongly damped wave-trains, having a frequency equal to that of the wire, is itself sufficient to set the latter in vibration. In this simplified form the instrument serves as a detector for a new system of wireless telegraphy in which no high-frequency tuning of the receiving apparatus is necessary, but only of the low-frequency vibrations of the wire, which may be done very readily by altering its length, and in which the signals are read directly by observing the band of light on the screen.—Lond. *Electrician,* Oct. 29.

Miscellaneous.

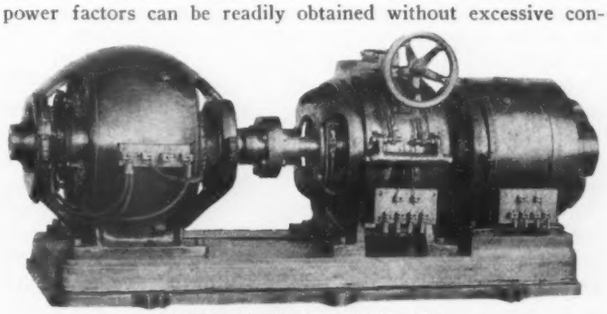
Fundamental Reasons for the Use of Electricity.—C. F. SCOTT.—Extracts from his Seattle paper on the trend in electrical development. The author discusses the possible fields of electric service, the conditions underlying the application of electricity, the methods and effects of using electricity, the methods of applying electricity effectively, cost of energy, new fields for central station activity, and electric heating.—*Elec. Journal,* November.

NEW APPARATUS AND APPLIANCES

Varying-Frequency Motor-Generator Testing Set.

An interesting motor-generator set recently installed in the testing department of the Commonwealth Edison Company, Chicago, is illustrated herewith. The unit was especially designed for its purpose, and it required careful calculation and accurate execution. The direct-current motor is of the adjustable-speed type capable of operating the two alternating-current generators at a speed varying from 750 r.p.m. to 1800 r.p.m., thus giving frequencies ranging from 25 cycles to 60 cycles. The generators furnish alternating current of true sine wave. The one at the extreme right is wound for 110 volts and the other for 50 volts. The 50-volt machine is arranged in such manner that the field rings supporting the pole-pieces may be rotated through 180 deg. The frame is supported on substantial bearings contained in the end brackets and is rotated by a worm-gear attachment operated by hand-wheel.

This testing set, designed and manufactured by Roth Brothers & Company, of Chicago, is used for calibrating alternating-current wattmeters. The pressure coil of the wattmeter is connected to the high-voltage machine through suitable transformers. The current coil of the wattmeter is connected to the low-voltage machine through other suitable transformers. The power factor of the load of the wattmeter may be varied from unity to zero by rotating the field ring and poles of the generator connected to the current coil. Thus artificial loads of all power factors can be readily obtained without excessive con-



MOTOR-GENERATOR TESTING SET.

sumption of energy and with the greatest exactness. The points of zero and unity power factor may readily be found by means of electrical testing instruments. The field ring is provided with a graduated scale which moves past the zero mark on the end rings and give an indication of the angle of lead or lag.

Electric Railway Tower Wagon.

A very convenient method of application of trackless electric vehicles for electric railway service is indicated in the accompanying illustrations of an electric tower wagon manufactured by the General Vehicle Company, of Long Island City, N. Y. The entire equipment of this wagon is mounted on the standard two-ton chassis of that company. All spring supports and special parts are vanadium steel castings, and all renewable parts are accurately machined to size. Friction has been minimized by the use of Hess-Bright ball bearings on the armature shaft, and Timken roller bearings for all wheels and countershafts.

Figs. 2 and 3 show the entire construction of the chassis. The frame is constructed of steel channels of such proportions as will best support the mechanism and carry the load. The 44-cell storage battery which furnishes electricity to the motor at 85 volts is suspended below the main frame in a substantial cradle where it can be reached easily. The battery is in sectional form in crates of such weight and size as can be easily removed and replaced from either side of the vehicle.

The controller is of the continuous-torque type which changes the motor speeds by degrees without interrupting the flow of

FIG. 1.—TOWER WAGON.

energy. This arrangement gives a smooth, even acceleration, without jar or strain of any kind, and thereby increases the life of the controller, battery, motor, chains, sprockets, gears and tires.

The single electric motor used has been especially designed by the General Electric Company for the sort of service demanded in electric transportation. It is built along the lines of an electric railway motor. The armature shaft turns on ball bearings, which increase the value of the other advantages of this design. The motor is suspended on a cross-bar pivoted to the side frames in front of the rear axle. The pivoted suspension keeps the motor shaft parallel with the countershaft throughout the entire range of chain adjustment, and permits the successful use of an efficient silent chain drive. The motor is totally enclosed and protected from water and dirt at all times. It is high above the ground and may be easily examined from the rear by opening a hinged cover in the motor frames.

Easy-running roller-bearing chains drive the rear wheels from the countershaft. Large diameters and properly designed teeth, combined with the chain, decrease transmission losses to a minimum. A single broad silent chain of the tooth-link type drives the countershaft from the motor-pinion. A rigid adjustment is provided to keep the chain in its best operating position.

The wheels are of the artillery type and have roller-bearing hubs. Solid rubber tires are used on all wheels. Half-elliptic springs are used both front and rear. Internal-expansion

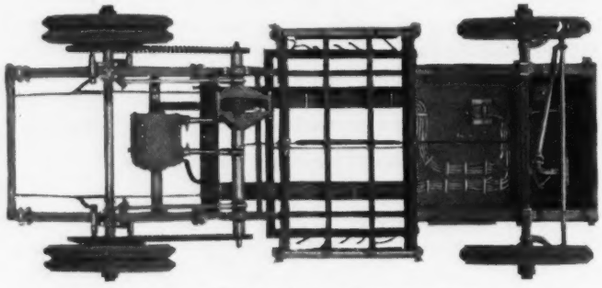


FIG. 2.—MECHANISM OF ELECTRIC VEHICLE.

leather-faced brakes on both rear wheels are controlled by a foot lever at the base of the steering post. The steering gear is wheel-operated through a vertical steering column.

The tower wagon has a speed of 12 miles per hour, and a range of service of 40 miles on one charge of battery. The wagon has sufficient space for seven men in addition to the driver, as well as space for tools and materials for repairs.

One of the important advantages of the electric wagon is its immediate readiness for service. Where adopted it will not be necessary for electric railway companies to maintain a team of horses constantly harnessed ready for emergency service;

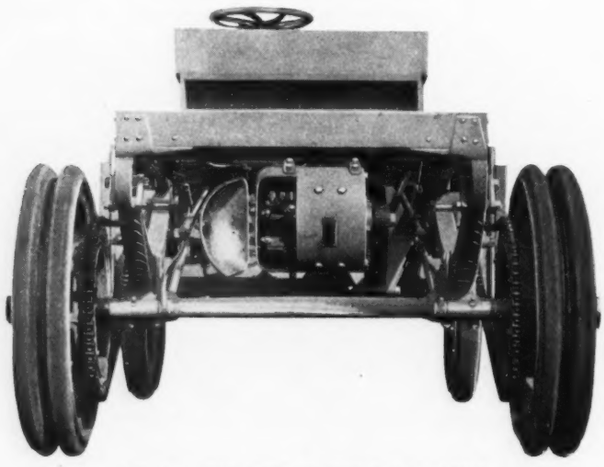


FIG. 3.—REAR VIEW OF TWO-TON CHASSIS.

the constant care of horses can be eliminated. A broader adoption of electric vehicles by street railway companies will enable them to discontinue horse service entirely. The electric emergency wagon can be held always ready for immediate service, and it drives at a speed equal to the limit of safety for city traffic.

Magneto and Plug for Slow-Running Internal Combustion Engines.

The Bosch Magneto Company, of New York, has brought out a magnetic plug-ignition system for single-cylinder, producer-gas, suction-gas and other engines, in which not more than 250 explosions per minute obtain. The current is produced by an oscillating motion of the armature between the pole shoes of permanent steel magnets, and the movement of the armature is brought about by two springs operated by a belt-crank lever from the camshaft of the engine. The magneto has no advance and retard, and the plug is connected to it with single-wire cable, the contacts of the plug between which the spark

occurs projecting into the interior of the combustion chamber of the engine. Fig. 1 shows a cross-section of the magneto. There are three steel magnets 1 between the pole shoes of which oscillates the armature 2. The latter is moved out of its normal position to an angle of 30 deg. at the moment of ignition, and is pulled back to its original position by the balance springs. This movement is caused by the operation of the camshaft of the engine by means of a rotating thumb-piece or other suitable appliance. For this purpose a double-belt crank lever is attached to the armature spindle, to the horizontal arm of which are fixed the balance springs 3, whereas the vertical portion of the belt crank lever is actuated by the attachment on the camshaft. By the movement of the crank lever a tension is brought onto the springs 3, which are released again at the moment the camshaft thumb passes out of engagement with the lever. The springs thus cause the armature to return quickly to its original position again, and by this movement an e.m.f. is set up by reason of which a current is produced. One end of the armature winding is connected to the magneto body, where as the other end is connected to an insulated brass plate 4, which has a tube-shaped extension reaching through the hollow armature spindle. A brass cap 5 is screwed over the end plate, but insulated from it, and on the inside has a brass projecting piece which reaches into the tubular sleeve of the armature spindle. Between these projecting pieces and the tubular sleeve is a spring 6 which conducts the current from the end of the armature winding to the brass end cap, the spring being pressed into

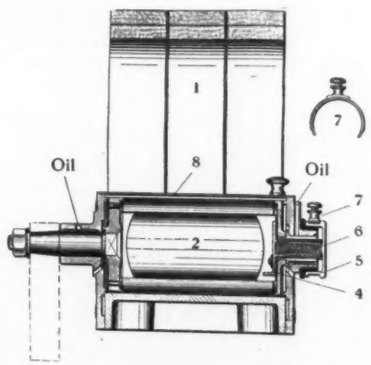


FIG. 1.—LONGITUDINAL SECTION.

the bore of the tubular sleeve on one end and over the brass projecting piece of the cover 5 on the other. This spring follows the oscillating movement of the armature, thus conducting the electricity from the moving parts of the magneto to the fixed terminal without the necessity of brushes or similar devices. The cover 5 has a flat groove in its outer rim, which receives the spring clip 7, which, when in position, makes contact more than half-way around the brass cap 5, and also carries the terminal screw for connecting the cable to the spark plug of the engine. Since this spring clip can be placed in any position on the brass cover, the cable can be connected from any convenient point. The circuit runs from the armature through the spiral spring 6, through the spring clip 7 to the wire and the plug, through the coil of the latter, through the interrupter to the engine and magneto body, and thence to the armature winding.

The magnet plug used in connection with the magneto is shown in Fig. 3. The interrupter lever rests on a steel-knife edge, and also on the contact block. One end of the spring 3 is pressed against the contact of the interrupter just inside the knife edge, this arrangement facilitating the movement of the interrupter and spring, and reducing the wear to a minimum. The spring has a very slight movement, and is protected from hot gases by being placed within the coil body. The latter has its lower end screwed to the pole-piece of the plug, thus forming a complete system, the armature of which is the upper part of the interrupter lever. Contact pieces 20 and 21 are mounted upon the interrupter lever and the plug body, the latter reaching into the interior of the combustion chamber of the engine. The two contacts are pressed against each other by means of the spring 3, and are separated only at the time of sparking, at which moment the coil is energized. For this purpose one end of the winding is in connection with the ring 6, and through this to the terminal 9, while the other end is in electrical con-

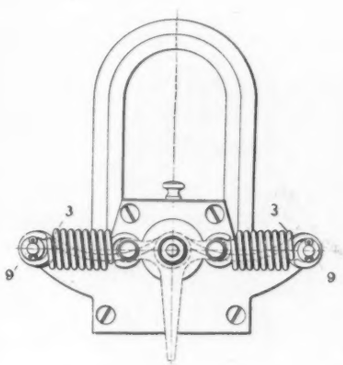


FIG. 2.—REAR VIEW.

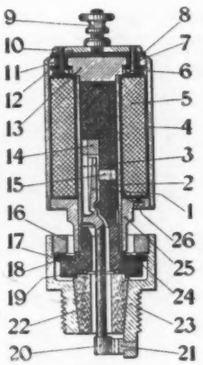


FIG. 3.—SECTION OF MAGNET PLUG.

nection by means of a screw 26 with the body of the coil. The latter, as well as the pole-piece and the interrupter, is insulated from the plug body by means of a steatite cone 23 and mica washers 18. The two contact pieces on this plug have a special form, inasmuch as the fixed contact takes the form of a V into which the moving contact drops. The interrupter level also has a slight side play. If, for instance, the left side of the contact should be insulated, owing to soot or deposits from burning oil, etc., the flats would be cleaned by the downward movement of the hammer, thus procuring a contact on the other side, one side of the V-shaped groove acting as a reserve contact.

Steel Reflectors.

A line of new "Extensive" and "Intensive" type of Holophane-D'Olier steel reflectors, manufactured by the Holophane Company, Newark, Ohio, has been designed to render practical the use of standard voltage tungsten lamps for industrial lighting. The new reflectors give the characteristic distributions of the Holophane "high-efficiency" glass reflectors, and enable the illuminating engineer to undertake mill and factory lighting problems in the same way as he would handle a residence or commercial problem.

Tungsten lamps have heretofore not been largely availed of for industrial lighting because of the high percentage of breakage, as workmen could not be taught to handle the lamps carefully. It is claimed that the new Holophane-D'Olier steel reflectors enable the lighting engineer to install tungsten lamps safely, as these reflectors give the best results when the units are hung high and out of the workmen's reach; and that while

STEEL REFLECTORS,

they are of such exact design as to commend themselves to the illuminating engineer, it requires no expert skill or deep engineering knowledge to use them with complete satisfaction wherever the "group lighting" or "distributed unit" system of lighting is desirable.

Adjustable-Speed, Single-Phase Commutator Motor.

The single-phase commutator motor illustrated herewith is of the repulsion induction type particularly adapted to the operation of machines requiring constant or variable speed

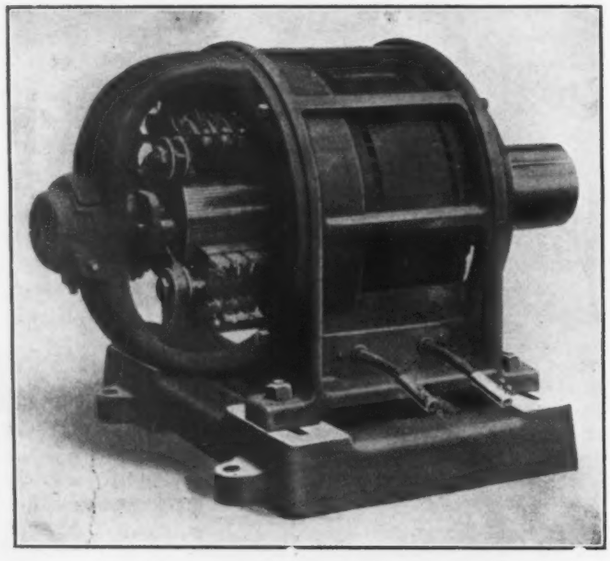


FIG. 1.—VIEW OF REPULSION-INDUCTION MOTOR.

and moderate or heavy starting torque. It is entirely automatic and may be connected to the line without the interposition of any starting box, clutch coupling or other external device.

The motor is made exceedingly compact by the use of the

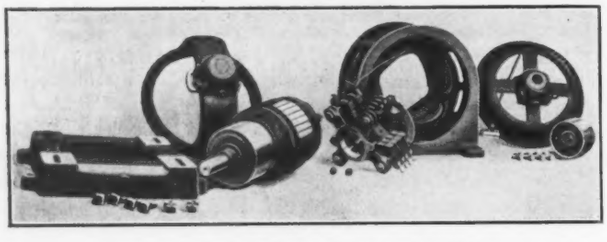


FIG. 2.—CONSTRUCTIVE DETAILS OF MOTOR.

open frame form in which the laminations of the stator core are clamped between cast-iron held in the frame to which the end-heads are secured. The field core of the motor is provided with a single-phase winding of the concentric type, each coil

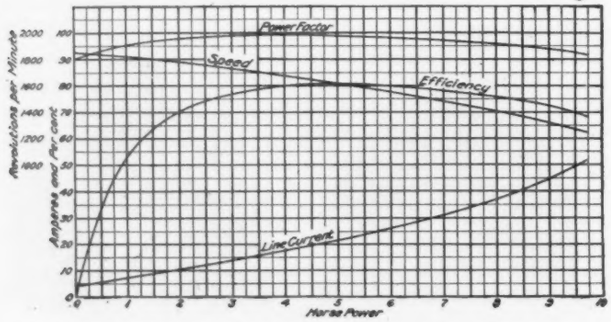


FIG. 3.—OPERATING CHARACTERISTICS OF 5-HP REPULSION-INDUCTION MOTOR.

being taped and insulated separately; the coils can be arranged in series for 220 volts, and in parallel for 110 volts.

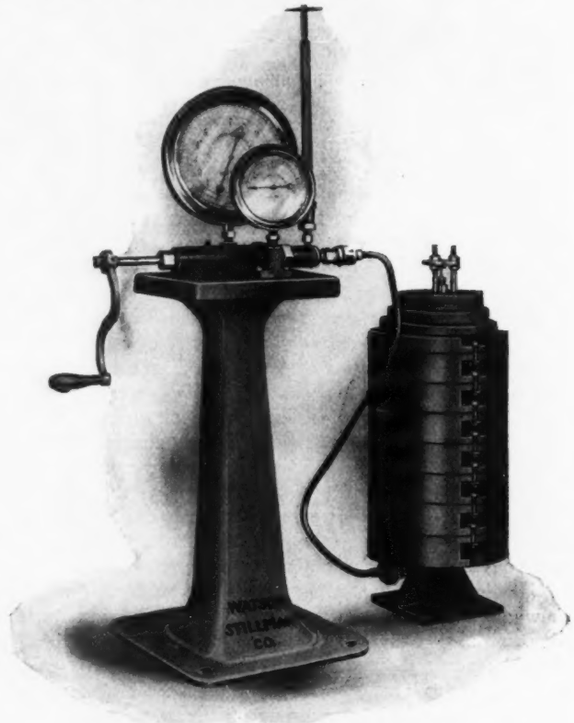
The armature winding is of the series drum type connected to a commutator carrying two sets of brushes, each set being displaced electrically from the other by 90 space degrees. The first set, known as the energy brushes, is permanently short-circuited and disposed at an angle to the lines of field or primary magnetization, as in an ordinary repulsion motor. The second set, or compensating brushes, is connected to a small portion of the primary winding included in the field circuit, so as to impress upon the armature an electromotive force which serves both to raise the power factor and at the same time maintain approximately a constant speed at all loads.

By the use of the proper controllers the motor speed can be adjusted by as much as 50 per cent below the synchronous value by inserting resistance or reactance in the energy and compensating circuits. With the exception of the leads brought out from these circuits the constant-speed and variable-speed motors are identical.

These motors are built in five sizes rated at 0.5 hp, 1 hp, 2 hp, 3 hp and 5 hp respectively. The advantages claimed for this type of motor by the manufacturers, the General Electric Company, Schenectady, N. Y., are noiseless operation, attractive design, improved ventilation, excellent cooling and overload characteristics, compact and rigid construction, least weight consistent with proper mechanical strength and the sustaining of high electrical constants, self-starting with rapid acceleration, and wide speed control.

Calibrating Apparatus for Hydraulic and Other High-Pressure Gages.

Under higher hydraulic pressures, it is frequently the case that the same pressure gage will show different percentages of error at different pressure readings, and these can be compensated for in ascertaining the true pressure only by comparing with a "master" gage of known accuracy or by loading with a known pressure. The outfit which we illustrate performs these two functions of testing by comparison with a master gage and of testing the accuracy of the master.



CALIBRATING APPARATUS.

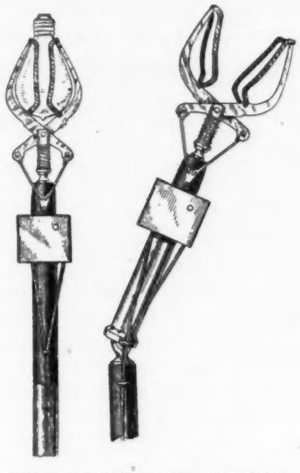
For the first, only the part on top of the stand is required. This consists primarily of a cross made of hydraulic bronze. The gage being tested, which may register any pressures up to 16,000 lb. per square inch, and the master, are attached to the front and back ends of the cross respectively. At the left

is a crank-operated screw displacement piston, by means of which the desired pressure may be produced within the pressure chamber. A suitable stuffing box prevents leakage past the piston. To the right end is connected a stop valve and filling cylinder. This permits (1) some of the liquid to be withdrawn from the pressure chamber before removing the gage being tested, and (2) filling after a gage is put on. There is thus no danger of spilling the oil.

For testing the master gage, the special weight-loaded, hardened and ground-steel piston and cylinder are attached at the right by means of flexible copper tubing, as shown. These parts are cut out by a stop valve when not testing the master. The cylinder is long enough to have the center of gravity of the weight below the center of support. When the weights are revolved, the friction due to lifting the weight is practically eliminated. The apparatus is made by the Watson-Stillman Company, of New York.

Device for Removing or Cleaning Lamps.

The accompanying illustration shows an electric lamp remover and cleaner made by E. E. Edgerton, Chicago, Ill. It is adapted for lamps ranging from ½ in. to 4 in. in diameter and 6 in. long. The clamps are covered with rubber, and are



LAMP CLEANER AND ADJUSTER.

made to grip the lamp by a pull of a cord. Once fastened the clamps are held by a ratchet until released by another cord. The clamp is attached to a light wooden pole of suitable length, and made in two forms, one for removing lamps which project vertically downward, and the other for removing lamps which are placed at an angle. The details of the device are clearly shown in the engravings.

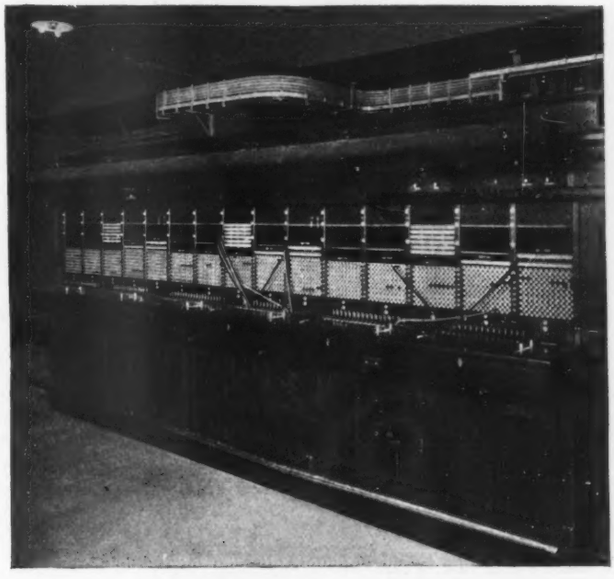
A Chicago Hotel Telephone System.

The La Salle Hotel, which has recently been erected at the corner of La Salle and Madison Streets, Chicago, was opened to the public Sept. 8. The structure is 20 stories, or 260 ft., high, exclusive of the basement and sub-basement. The architecture is that of the French renaissance, and the interior finish and furnishings have been made according to special designs, following as closely as is consistent the style of the same period as the building.

All the guests' rooms are provided with the most up-to-date conveniences, including local and long-distance telephone service. The hotel has its own private branch exchange, consisting of a six-position Western Electric switchboard. This switchboard is of the latest relay type for hotel use, and connects 1100 instruments for inside service and has 22 trunk lines leading to the Main-Franklin exchange, through which long-distance and local service is furnished.

The installers usually require three months' time for such an equipment. The hotel corporation could give the telephone company, however, in this case but four weeks' preparation and 14 hours' notification to begin work, and this notification was given but five days before the hotel was to be opened to the public. As soon as the specifications were available, a complete switchboard was set up on an assembly floor and all the cables formed out, tagged, taped into their relative positions, and then taken down and rolled carefully on separate reels. All of the house-wiring cable was cut to exact lengths, the terminal ends formed out, shellacked and taped, then put on reels properly tagged with contents, floor number and location at which it was to be used.

The work was divided into three main parts, the first taking in the switchboard proper, the second the telephone power plant, and the third the instruments' setting and conduit wiring. For handling the cables a gang foreman was appointed, with enough helpers to take charge of each cable splice to be made. Very explicit instructions, with blue prints detailing what they were to do, were given each gang. For the house wiring and in-



HOTEL SWITCHBOARD.

struments' setting each installation foreman was assigned several floors. Sub-foremen were appointed for each vertical shaft on each floor, and specific written instructions and blue prints of the conduit layout at their particular positions were furnished. A force of 50 equipment men, divided into two shifts, took charge of the telephone power plant.

At 5:30 p. m., Sept. 2, instructions were given to commence work. All that night the material was being disassembled and loaded on trucks. At 8:30 the following morning the first of the 18 truck-loads of material was unloaded. By 3 p. m. all of the material had been unloaded and distributed, and by evening the force of workmen had been gradually increased until 500 men were at work, each one having gone to his previously assigned position as soon as he entered the building. Twenty-four hours after work began, the 22 trunk lines, to the Main-Franklin exchange, connecting the switchboard in the building with the city exchanges, were operating. Forty-two hours after the work began the entire switchboard installation, except fitting the operators' foot rail and similar minor details, was completed. Thirty hours later the greatly reduced force of installers had spliced the last cable and the complete equipment of a six-position, common-battery switchboard, and a complete telephone power plant, was installed. The whole was in operation two days before the hotel was opened, although but three days previous to completion the entire equipment was on the Western Electric Company's shipping floors.

Electric Water Heater.

While electrical heating apparatus possesses an efficiency of 100 per cent, the cost of operating such devices has always been considered expensive. Messrs. Spagnoletti, Ltd., Goldhawk Road, London, Eng., have introduced the "Therol" electric water heater, which differs essentially from other apparatus of

FIG. 1.—ELECTRIC WATER HEATER.

this class, and by means of which the expense of heating is said to be reduced. In its simplest form, the apparatus consists of a block of iron cast about a coil of pipe. This block is embedded and covered with a layer of magnesia lagging 2 in. thick. The top of the block is hollowed out into a cylindrical form, and in this hollow is placed the heating element, consisting of four coils of iron wire insulated with mica. The block of iron is continuously heated by means of electricity, and water as required is passed through the pipe. By this means electricity is taken constantly from the mains, and hot water is always available in any quantity, provided the average daily amount does not exceed a certain volume depending upon the fixed amount of electricity consumed. A further economy is effected by introducing between the lagging and the outer

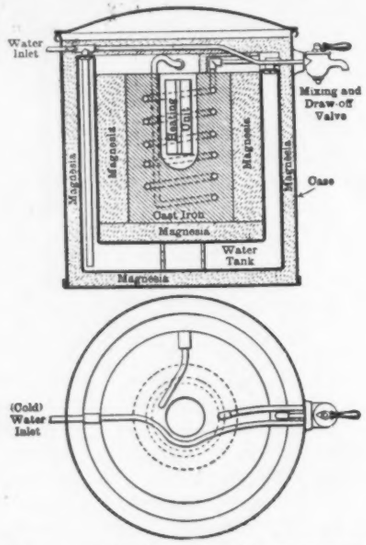


FIG. 2.—PLAN AND SECTION OF HEATER.

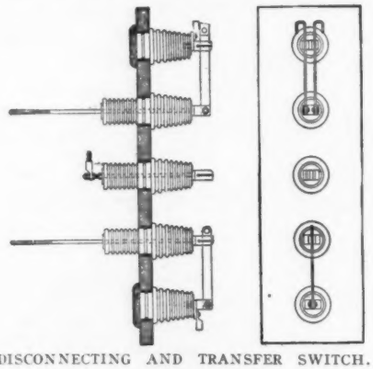
cover a small reservoir, which is in turn insulated from the outer surface of the heater. In this chamber the temperature of the incoming water is raised slightly before it is introduced to the heater proper. This will be evident from an examination of Fig. 2, which shows a plan and section of the device. Since the cooling pipe through which the water passes must have sufficient surface for heating the water when the block is comparatively cool, it follows that when the latter is very hot the water will be converted into steam. It is necessary therefore to mix the issuing steam with water, and thus reduce it to a suitable temperature. For this purpose a valve has been designed by the use of which it is claimed a mixture of the steam and water is completely effected, and the temperature of this mixture adjusted at will. No 1 heater is cylindrical and is 2 ft. in external diameter and height. When consuming 200 watts, if the initial temperature of the water is 50 deg. Fahr., 25 gal. of water at 110 deg. Fahr. may be obtained per day; while if only warm water is required a very much larger quantity may be obtained. In every case the amount of water available may be drawn off all at once, or in smaller quantities at any time during the 24 hours. The heating resistances are made readily accessible, so that by the mere substitution of a larger heating element the supply of hot water can be increased within certain limits. The manufacturers state that the basic idea of the "Therol" system is to meet the demand for a 24-hour constant supply of electricity giving a 100 per cent load factor. The idea is that a constant supply of electricity will be available for lighting, cooking, heating and other domestic applications when these are required, and at all other times during the 24 hours it will be stored in the heater for the supply of hot water. This disconnection of the heater from the mains for short periods does not interrupt the supply of hot water, but only slightly reduces the average amount available.

Combined Disconnecting and Transfer Switch.

The requirements of modern distributing systems necessitate more flexible and selective control than is afforded by the usual system of circuit-breakers, switches, etc., and this need has resulted in the development of many special forms of switching devices. In many cases it is important that these auxiliary devices shall not only possess the desired flexibility, but also shall be of such dimensions that they will not interfere with existing apparatus, the physical arrangement of which cannot be changed.

A recent requirement for combined disconnecting and transfer switches was met by the design illustrated herewith. The lower switch is of the single-pole, single-throw type and arranged to be connected in series with the lightning arresters, thus permitting the arrester circuit to be opened for inspection, replacement, etc., of arrester units. The upper element of the device consists of a double blade, single-pole, double-throw transfer switch, enabling connection to be made to either the upper or lower contacts, as desired.

By use of a double set of lever blades and contacts, it is possible to transfer the circuit without interruption, or subjecting the switch to destructive arcing. It will be noticed that the switch is a combined front and back-connected device, and the lever blades are provided with off-set extensions, thus permitting them to be operated in the usual manner by means of an insulated pole, or hook. This combined device has a carrying capacity of 300 amp at 13,200 volts, and was developed by the Central Electric Company, Chicago, Ill.



DISCONNECTING AND TRANSFER SWITCH.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The general tone of commercial affairs continues to be buoyant, and every report shows that business on the whole is improving. The continued mild weather throughout the country has acted both as a stimulant and as a check to different lines of trade. It has increased retail sales, has facilitated the fall work of the farmers and has aided in getting their products to market. On the other hand, the warm weather has retarded the sale of heavy clothing, and the wholesalers and jobbers are complaining that orders are showing some falling off in this line. In the South especially the continued high price of cotton has had the effect of furnishing plenty of money to the planters and has added very materially to retail trade and to the payment of outstanding bills. This is also reflected in the export report, the value of cotton being the principal item of advance over last year. In the industrial field the reports are still that order books are filled up and that mills are running full time. There is not, perhaps, the same rush that was witnessed in October, but new orders are coming in, and there is in sight enough work to run far into the spring. The continued improvement in business has had its effect upon collections, and they are now all that wholesalers could expect. Business failures for the week ended Nov. 11 were 221, as against 212 of the previous week, 216 the same week in 1908, 259 in 1907, 222 in 1906, and 198 in 1905.

THE COPPER MARKET.

In spite of adverse statistics and a disappointing report from the Copper Producers' Association, there has been during the past week a decided improvement in the tone of the copper market and some improvement in price. Electrolytic on Nov. 15 sold around 13¼ cents. This is due entirely to the faith placed by the public in the reports that some extensive combination of interests is in process of formulation. While it is explicitly denied that a great central combination similar to the Steel Trust is in contemplation, and while the third largest producing interests in the country declare that they are not concerned in any agreement of any kind, there is a widespread belief that in the near future the copper market, both in the matter of production and price, will be in perfect control. The consumers, both in this country and in Europe, have been industriously warned that this was their last chance to get metal at bargain prices. The rapid advance of the shares of copper companies has added weight to these warnings, and the result has been much more liberal buying by the melters. These larger purchases are regarded as purely protective measures and not as an indication that the demand for finished goods has suddenly increased. They are purchases which do not mean a reduction of the visible supply of copper but a shifting of its ownership. The figures of the Association for October showed that the record for production had again been broken. The total for the month was 124,657,709 lb. The deliveries were reported as 122,620,855 lb., the heaviest since July, leaving an addition to the stocks in this country of 2,036,854 lb. At the end of the month the total stocks in producers' hands are reported as 153,509,626 lb, the heaviest since the June report, and 25,000,000 lb. more than the amount on hand at the beginning of the year. The exports for the month, including Nov. 15, have amounted to 10,030 tons. The daily call on the Metal Exchange Nov. 15 quoted standard copper as given in the table.

	Bid.	Asked.	Settling price.
Spot	12.60	12.75	....
November	12.60	12.75	12.67½
December	12.60	12.75	12.67½
January	12.70	13.00	12.85
February	12.80	13.10	12.95
March	12.60	13.15	13.02½

The London prices on Nov. 15 were as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	59	0	0	59	0	0
Standard copper, futures	60	5	0	60	2	6
Market	Firm			Steady		
Sales of spot				400 tons		
Sales of futures				1,000 tons		

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard	13.00			12.12½		
London, spot	£64	2	6	£54	12	6
London, futures	64	17	6	55	10	0
London, best selected	67	15	0	59	0	0

COLORADO RIVER POWER PLANT.—Plans have been prepared by Colonel C. E. Apponyi for the development of a hydroelectric plant upon the Colorado River at the first rapids above the head of high water navigation, about 180 miles above Needles, Col. The point selected for the plant is between Lincoln County, Nevada, and Mojave County, Arizona. Water rights for a strip of five miles have been secured, and it is estimated that at least 30,000 hp can be generated by the use of four successive turbo-generator units, each working under a 50-ft. head. Energy will be transmitted to Tonopah, Nev., 170 miles away, and to Prescott, Ariz., 160 miles away, and will also be sold to intermediate mining camps.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—The East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company began work last week upon the heavy order for motors and equipment for the Long Island Railroad Company. This order calls for 130 car equipments, of two 200-hp motors each, together with controls, wiring, conduits and airbrakes. The total amount of the contract amounts to almost $1,000,000. The apparatus will be delivered early in 1910, in time for the installation of electrical operation on the Long Island system, in connection with the completion of the Pennsylvania tunnels.

GALVESTON-HOUSTON ELECTRIC RAILWAY.—The new interurban line which will be constructed between Galveston and Houston, Tex., will be about 45 miles long, and will be constructed entirely on private right-of-way. The main power house will be located in Texas City, in Galveston Bay, and will include two turbo-generators rated at 100 kw and 500 kw. The line will be operated at 600 volts, direct-current, using the overhead trolley system. Four substations will be provided along the line, located about 10 miles apart. The company will operate over the tracks of the local companies in both Galveston and Houston.

ELECTRIC POWER FOR COKE FURNACES.—The Board of Trade of Big Stone Gap, Va., writes that it desires to direct attention to the opportunity for the development of cheap electric power from the waste gases of coke furnaces There are about 3800 coke furnaces in the vicinity of Big Stone Gap, which would supply sufficient gas for use as fuel or in internal-combustion engines to operate a large electrical generating plant, which could sell its product in the vicinity or transmit it to a distance.

PITTSBURGH STREET LIGHTING.—The Public Works Committee of the Pittsburgh Council has recommended that the city enter into a contract for a period not exceeding three years for lighting the streets by electricity at a cost not to exceed $325,000 per year. The ordinance for the lighting of some of the streets and alleys by incandescent gas mantle was amended to include also electric lamps, provided that the expenditure did not exceed $100,000 per year, and the contract was for not more than three years.

GENERAL ELECTRIC BRANCH MANAGERS.—The branch managers of the General Electric Company held their meeting in Schenectady Nov. 9. All sections of the United States were represented, and the business situation was thoroughly discussed. The general sentiment expressed by these men was that the electrical trade is rapidly improving, and that the return to normal conditions is practically in sight.

APACHE FALLS (ARIZ.) POWER PLANT.—Plans have been drawn for the construction of a hydroelectric plant at Apache Falls, Ariz., which is 30 miles above the Roosevelt Dam on Salt River. The plant will cost about $600,000, and the energy will be transmitted to Globe, Ariz., 35 miles away. Globe capitalists are backing the enterprise.

RECENT ALLIS-CHALMERS ORDERS.—The Allis-Chalmers Company reports the following orders: The Providence Gas Company, of Providence, R. I., two Corliss engines direct-connected to 300-kw, 240-volt, direct-current generators with barometric condensing equipment to be used in connection with an electric system for handling gas. C. A. Borst, who has secured the contract for municipal lighting in Clinton, N. Y., has ordered a 100-kw, 2300-volt, 60-cycle, two-phase, belted alternator, engine, exciter and switchboard equipment. The Rapid Motor Vehicle Company, of Pontiac, Mich., is enlarging its plant by the addition of two 600-kw, 240-volt, 60-cycle, three-phase machines and cross-compound engines. The City of Thomasville, Ga., has placed an order for electrical equipment for the municipal lighting plant. This consists of one 250-kw, 2300-volt, three-phase, 60-cycle generator, one 200-kw generator and two exciter sets. The Marion Steam Shovel Company is building an electric shovel for the Casparis Stone Company, which is equipped with two 75-hp, series-wound, direct-current motors and one 150-hp motor with the necessary controlling apparatus. The Land & Power Company, of Arkansas City, Kan., is extending its activities, and has purchased a 500-kw turbine and a 2300-volt, 60-cycle, three-phase machine, exciter and control board. The Delaware, Lackawanna & Western Railroad is about to install two 500-kw, 6600-2300-volt, three-phase, 60-cycle transformers at Kingsland, N. J. The transformers will be water cooled.

WESTERN ELECTRIC COMPANY'S BUSINESS.—The October sales booked by the Western Electric Company amounted to nearly $4,500,000, or at the rate of about $53,000,000 per year. The October gross was the largest in any single month since May, 1907. For the 11 months period the Western Electric's sales have been at the rate of a little more than $47,000,000 per year, which is an improvement of 43 per cent over the same 11 months last year. In the company's fiscal years which ended Nov. 30, 1907, and Nov. 30, 1908, the earnings failed to show the full 8 per cent dividend on the $15,000,000 capital stock. It is probable, however, that the earnings this year will show the full dividend. It is stated that the steady advance in prices, not so much in telephone supplies as in general electrical apparatus, has very greatly benefited the earnings of the company, and that the sales of apparatus for the 11 months are 40 per cent greater than last year.

AMERICAN TRADE IN JAPAN.—The electrical trade of American manufacturers in Japan is reported to be steadily increasing. There have not been within the last two months any particularly large orders which are worthy of note, but one of the largest export firms in New York says that all through Japan the electrical development is increasing, and furthermore that Japanese manufacturers are not popular. The contest for trade is between the Americans and the Germans. In many cases heretofore the Germans have underbid the Americans, especially for large orders. This American exporter claims that the German goods have proved unsatisfactory in a number of instances, and that therefore the Japanese are particularly looking for American products. Within the last three months there has been considerable exports of electrical apparatus to Japan, but most of it has been for small appliances, generally motors under 100 hp.

WESTCHESTER LIGHTING COMPANY.—At the investigation into the affairs of the Westchester Lighting Company, which is being conducted by the Public Service Commission of the Second District on the complaint of the residents of White Plains and Port Chester, it has been testified to that the company has various rates for certain sections of its territory. The attorney for the complainants stated that the company sold gas at 80 cents in the Bronx, and at $1, $1.10, $1.40, $1.50 and 90 cents in various villages in Westchester County. It was stated that the rates for electricity were 10 cents in the Bronx; 13 cents in Mt. Vernon; 13 cents in New Rochelle; 15 cents in Rye, and 5 cents in Greenwich. The same attorney also urged that the company now had $12,500,000 in stock and $7,307,000 in bonds, and that the value of the property was about $5,000,000.

NEW HAVEN SUBWAY PLANS.—At the hearing before the Massachusetts Railroad Commission, concerning the taking over of certain properties by the New Haven road, Charles S. Mellen, president of the company, protested against the law which required the company to secure the consent of Massachusetts authorities before it could issue securities to pay for improvements in New York. Mr. Mellen said: "Our company has tremendous interests in the State of New York. We are at present expending $35,000,000 there, and it may be that we shall be obliged in the near future to build a subway into the city to take care of our suburban business. It is not fair to our patrons who are benefited by these improvements that we should be obliged to ask the consent of Massachusetts authorities before we can undertake them."

CLEVELAND CENTRAL-STATION TAX VALUATION.—A board of review has increased the tax value of the property of the Cleveland Electric Illuminating Company, Cleveland, Ohio, from $3,136,510 to $3,500,000, an addition of $363,490. Some time ago the Ohio Light & Power Company brought a protest against the valuation placed on the property of its rival. Experts were employed to go over the property and arrive at a valuation for the board of review, and members of the board themselves did quite an amount of work on it. The addition is small, in comparison with the figure set in the protest, and the officers of the company feel that they really won a victory after all because of the small change made.

NEW CANADIAN TRACTION LINE.—The purchasers of the Southwestern Traction Company at London, Ont., have made application to the Dominion Parliament for the incorporation of the London & Lake Erie Railway & Transportation Company, with a capital of $2,000,000. The company proposes building a road north of the Grand Trunk to Ingersoll, where it will absorb the Ingersoll and Woodstock electric lines. The line will probably be pushed eastward to Brantford over the proposed Hamilton and Windsor route. This will give it connection at Brantford with the Niagara power companies. Several other branches are also contemplated.

SOUTHERN POWER COMPANY DEVELOPMENT.—The Southern Power Company, Charlotte, N. C., is making surveys with a view to extending its transmission service to the upper Catawba. A substation at Greenville will be completed Dec. 1, when electric power will be supplied to the Monaghan and Woodside cotton mills. A number of Albemarle cotton mills have closed a contract for electric power to be delivered from an 80,000-volt line passing through the town. A $600,000 cotton mill will be erected at Great Falls by the Duke interests, to be operated by electric power. The Southern Power Company now supplies power to more than 100 cotton mills.

HYDROELECTRIC PLANT IN CENTRAL IDAHO.—Plans have been perfected for the construction of a power plant on the Salmon River in central Idaho which will be one of the largest in the country. It is proposed to build a dam on the Salmon River, 40 miles below Grangeville, Idaho; to run a tunnel seven and one-half miles long under the mountains to the Snake River. It is estimated that a fall of 530 ft. will be secured and that 280,000 hp can be developed. R. J. Zell, of Spokane, Wash., is the engineer of the project, and Spokane capital is backing the enterprise. The company which is being organized will be capitalized at $6,000,000.

CHIPPEWA POWER COMPANY.—The application made to the authorities of Bay City, Mich., by the Chippewa Power Company for a franchise to furnish electricity has been withdrawn. This action was taken because the company concluded that it could not accept the rates which the city committee proposed in the franchise which was submitted to a vote of the people. The city owns and operates a municipal plant. The rates demanded by the committee were 7 cents per kw-hour for 100 kw or less; 5 cents from 100 to 150 kw, and 4 cents for all above 150 kw.

NEW YORK & NORTH SIDE TRACTION COMPANY.—A site has been purchased at Bayside Meadows, L. I., for the erection of new car barns and also a big power house to supply energy to the New York & North Side Traction Company's lines from Whitestone Landing to Flushing, and on other lines in Nassau and Queens counties.

NEW BUCKEYE LAMP FACTORY.—The Buckeye Electric Company, of Cleveland, Ohio, has arranged to build a factory at Hough Avenue and East Forty-third Street, that city, to cost $75,000. The building will be 122 ft. x 265 ft., three or four stories high, and will adjoin the Prospect factory.

CATALOGS WANTED.—The Schenectady Electric Clock Company, Schenectady, N. Y., desires to receive catalogs and quotations on material necessary in the manufacture of small motors.

ADVANTAGES CLAIMED FOR THE MOVING PLATFORM.—The Continuous Transit Securities Company, which proposes to build a moving platform system of rapid transit under Broadway, and has had its plans approved by the engineer of the Public Service Commission, claims that this method of construction has many advantages over any other. The company is headed by Max E. Schmidt, and quite a number of prominent railroad men are interested in the enterprise. The officials of the company claim that the moving platform can carry 125 per cent more passengers than can be carried by trains. In addition to this vastly increased capacity, it is claimed that there will be seats for all; no delay in waiting for trains; passengers may board or leave the platform at any point at will, and that exits can be made at every street crossing, instead of every one-third of a mile as on the present subway. The mechanism of this platform is similar to those exhibited at the World's Fair in Chicago in 1893 and at the Paris Exposition. It is claimed that on the highest speed platform, 16 miles per hour, 63,500 seated passengers can be carried past a given point every hour. The estimated cost of the construction under Broadway from Tenth Street to Forty-second is $11,000,000, and the money, it is promised, will be furnished by private parties, but the ownership of the line will be vested in the city.

CANADIAN ELECTRIC STEEL COMPANY.—A contract for 1000 hp has been made by the Electric Steel Company, of Canada, Limited, with the Falls Power Company, the local end of the Ontario Power Company, of Niagara Falls. The steel company has just been incorporated with head office in Toronto, by the following interests: Tyson S. Dynes, St. Louis, Mo., president; Geo. G. Goodrich, Saratoga, vice-president; A. S. Ramage, Ph. D., secretary. The company intends putting up a large plant for the manufacture of finished products in iron and steel, and the smelting will be done by means of electric furnace, the plant having been designed by Dr. Ramage. Work on the billet mill will be commenced in a few days, and the other buildings erected next year. The plant is to be located just outside Welland, at the junction of the Welland Canal proper with the feeder, the company having secured 50 acres with excellent shipping facilities by rail and water.

N. Y, N. H. & H. R. R. ADOPTS THE TELEPHONE FOR TRAIN DISPATCHING.—The New York, New Haven & Hartford Railroad Company has placed orders for telephone and selector apparatus for equipping the Northampton Division for telephone train dispatching. The equipment consists of Gill standard bridging selectors and Western Electric telephone apparatus. This will be the first circuit so equipped on the New Haven road, and covers a total of 77 miles, with 29 stations. From the success attending the installation of telephone train dispatching equipments on the other large roads which have adopted this system of handling train movement, the indications are that after the completion of the first circuit by the New York, New Haven & Hartford Railroad it will extend the system to other divisions of the road.

FOR BETTER FIRE FIGHTING FACILITIES.—A movement has been started, engineered by the fire underwriters and others interested in the amendment of the building code, to urge upon the new city administration, after it goes into office, the necessity of improving the fire fighting facilities in New York City. It is urged that the fire-alarm system is old-fashioned and worn out, and a report of experts made two years ago, and approved by the city engineer, calls for an expenditure of $2,500,000 for the installation in Manhattan of a new system, with headquarters in some place isolated from the risk of being thrown out of service by an adjacent fire. This report was never acted upon by the city authorities, and the present movement is intended to bring it to life.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in our present issue are announcements of proposed new plants or considerable extensions of present plants at St. Petersburg, Fla.; Springfield, Mass.; Big Pine, Cal.; Granite Falls, Minn.; Waverly, Kan.; Ralston, Okla.; Athens, Ga.; Valentine, Neb.; Beaver Falls, Pa.; New Castle, Col.; Winchester, Va.; Meriden, Conn.; Gulfport, Miss.; Bristol, Tenn.; Thurmont, Md.; Still Pond, Md.; Apache, Okla.; Poteau, Okla.; Aberdeen, S. D.; Gouverneur, N. Y.; Globe, Ariz.; Beaufort, S. C.; Erie, Kan.; Lincoln, Neb.; Hemlock, Mich.; Florida, N. Y.; Chico, Cal.; Manti, Utah; Columbus, Ohio, and Potomac, Va.

CARNEGIE AND PITTSBURGH TROLLEYS.—Andrew Carnegie has announced that he will add 20 per cent to any fund which the Civic Commission of Pittsburgh may raise for the betterment of traction conditions in that city. It is said that the commission intends to attack the 99-year franchise now held by the Pittsburgh Street Railways Company, and to make a vigorous fight for the betterment of transportation conditions.

Financial Intelligence.

THE WEEK IN WALL STREET.

The history of the past week in the stock market was neither very instructive nor very interesting. The money market continued to dominate the situation, and the fact that neither the English nor the German bank felt called upon to advance its rate of interest was taken as a distinct bullish influence. This contributed, on the whole, toward strengthening the market. Advances in price, however, were not marked, except in copper shares, for there was an uncertainty with regard to the policy of American banks, and the demand from the interior for crop moving purposes was greater than had been expected. While this restraining influence was still felt at the end of the week under review, on Nov. 15, the last day, there was an increase of activity and more buoyancy. The main feature of the market is the strength of the copper stock. Within the past three weeks Amalgamated has advanced 14 points and the volume of trading has been very heavy. Other copper shares have also shown marked advances. This is not due to the improved condition of the copper metal trade, but to the confidence felt by Wall Street in the reports that a copper agreement is near at hand which will control production and maintain a price for the metal that will insure profits for the producers. Among the other issues the industrials were particularly strong. This is a condition in keeping with the remarkable industrial revival the country is now enjoying. The outside demand for gold continues, but so far the drain has not been sufficiently heavy to cause alarm. Money Nov. 15 was quoted: call, 4 @ 5¼ per cent; 90 days, 5¼ @ 5½ per cent. The quotations in the table are those of the close, Nov. 15.

NEW YORK.

	Nov. 8.	Nov. 15.	Shares sold.		Nov. 8.	Nov. 15.	Shares sold.
All.-Ch.	15¾	15⅜	2,700	Int.-Met., pfd.	50⅛	55⅜	88,350
All.-Ch., pfd.	54¾	54⅞	2,990	Mackay Cos.	94⅜	93¼	1,500
Amal. Cop.	89	94	379,790	MackayC.,pfd.	76*	75*	200
Am. D. T.	20½*	20½*	.....	Man. Elev.	142¾*	140¼*	760
Am. Loc.	62⅜	62½	4,200	Met. St. Ry.	24¾*	27	650
Am. Loc.,pfd.	116	116*	477	N.Y.&N.J.Tel.	139¼*	139¼*	.....
Am. Tel. & C.	85*	85*	.....	Steel, com.	90¾	90⅞	555,570
Am. T. & T.	140¼	142⅞	23,320	Steel, pfd.	127	126⅜	4,525
B. R. T.	76¼	76⅜	22,670	W. U. T.	77¼	83¼	6,600
Gen. Elec.	163¼	162*	1,500	West'h., com.	86½*	85½	5,770
Int.-Met.,com.	20	23	303,170	West'h., pfd.	140*	134½*	200

PHILADELPHIA.

	Nov. 8.	Nov. 15.		Nov. 8.	Nov. 15.
Am. Rys.	45⅜	45	Phila. Elec.	13¼	13⅛
Elec. Co. of A.	12⅜	12⅜*	Phila. R. T.	27½	26¾
Elec. St. B'ty.	58½	58½	Phila. Trac.	89*	89*
E. S. B'ty, pfd.	30*	30*	Union Trac.	53½	52¾

CHICAGO.

	Nov. 8.	Nov. 15.		Nov. 8.	Nov. 15.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	136½	136
Chi. Rs., Ser 1	108*	108*	Met. El., com.	17*	17*
Chi. Rs., Ser. 2	34*	33½	Met. El., pfd.	52	52½*
Com. Edison	119½	119	Nat'l Carbon	97*	97
Chi. Subways	7¼	6½	Nat'l Car., pfd.	120*	120*

BOSTON.

	Nov. 8.	Nov. 15.		Nov. 8.	Nov. 15.
Am. T. & T.	140	142½	Mex. Tel.	3¼*	3*
Cum. Tel.	146	146*	Mex. Tel., pfd.	6*	6*
Edison E. Ill.	250	250	N. E. Tel.	134	134¾
Gen. Elec.	162	162*	W. T. & T.	11	11¼
Mass. E. Ry.	18½	16¼	W. T. & T., pfd.	89	89*
Mass. E. R., pfd.	84	80			

* Last price quoted.
Shares sold are for week of Nov. 8 to Nov. 13.

NEW JERSEY PUBLIC SERVICE CORPORATION EARNINGS.—A circular letter has been sent to two important banking firms by Thomas N. McCarter, president of the Public Service Corporation of New Jersey, which shows that the gross earnings of that company have increased steadily during the last five years, and that on Nov. 1 the surplus over interest charges was $1,133,234. Mr. McCarter expressed the opinion that the funds of the corporation available for interest on the bonds will be at least three times the amount required. The official report of the company for the year ended Sept. 30, 1909, just made public, shows gross receipts of $25,921,892, and total expenses, including taxes, rentals and fixed charges of subsidiary companies of $23,235,533.

COPPER INTERESTS GET TOGETHER.—The much-talked-of negotiations which have been pending between leading copper men and representatives of the Amalgamated interests have reached the point where alternative plans are being considered. The first of these plans is the formation of a holding company along the lines of the United States Steel Corporation, the securities of which would be transferred for the securities of the producing companies. Another plan suggests the formation of a general selling agency, which would control the output of leading mines and be able to regulate production according to the market demand. Still another suggestion is for the organization of several groups of copper producers in various sections, with an understanding or agreement between the several groups. Of these three plans the one most generally favored is that of a holding company. The adoption of any one of these plans would mean the settlement of the smelting competition between the Guggenheim and Amalgamated interests. John D. Ryan, president of the Amalgamated Copper Company, while not giving out which of the plans he favors, has announced himself as positively in favor of restricting the output of copper, in order to prevent the accumulation of surplus stocks. A representative of Phelps, Dodge & Co. says that his firm has not been invited to participate and would not go in if invited. In connection with this amalgamation it is stated that the principal copper producers of British Columbia are about to be merged or come to an agreement. Such a consolidation would have a thorough understanding with American producers.

NEW YORK EDISON COMPANY SURPLUS.—According to the report for the year 1908 filed with the Public Service Commission, which has just been made public, the New York Edison Company had a corporate surplus on Dec. 31 of $14,835,546. Assets on the balance sheet showed a grand total of $131,764,516. The total funded debt is $44,062,395. Figures bearing on operation show that during the year the company delivered 252,416,153 kw-hours of energy, for which it received $15,228,716. The company at the end of the year had 73,522 consumers, an increase during the year of 8284, of which increase 7163 were in Manhattan and 1121 were in the Bronx. The company had 90,283 meters in service, and a connected load at a 16-cp equivalent of 6,729,926. There were 41,822 arc lamps and 3,429,266 incandescent lamps in service. The report of the Long Acre Electric Light & Power Company for the same period showed assets of $684,955, of which $566,313 was the estimated value of the franchise. The gross operating revenue was $3,804, and the total operating deficit was $20,586. The company had 10 consumers and 11 meters in Manhattan.

BRAILEY BUYS ANOTHER TELEPHONE COMPANY.—It has been announced in Indianapolis that James S. Brailey, Jr., of Toledo, has purchased a controlling interest in the new Long Distance Telephone Company of Indiana. The stock was owned largely by Indianapolis interests, and the price paid by Mr. Brailey for these holdings is said to have been about 60 cents on the dollar. The report published in Indiana that Mr. Brailey was acting for Bell interests is explicitly denied by him. In our issue of Oct. 28 was pubished a personal denial from Mr. Brailey that in his acquirement of the Ohio Home Telephone Company, and other Independent concerns in the neighborhood of Cleveland, he was acting for Bell interests. In this statement Mr. Brailey said that he had been for two years organizing a consolidation of Independent telephone interests in the Middle West.

QUEBEC RAILWAY, LIGHT, HEAT & POWER COMPANY.—The consolidation of the public service properties at Quebec, referred to in the issue of Nov. 4, has been effected and articles of incorporation filed for the Quebec Railway, Light, Heat & Power Company, the new holding concern. The properties taken over are the Quebec Railway & Power Company, the Quebec Gas Company, the Frontenac Gas Company, the Canadian Electric Company, the Seven Falls Company and several smaller concerns. The capital stock of the new company is to be $10,000,000. It was announced that the Quebec-Jacques Cartier Electric Company was also included in the deal. Emerson McMillan, of the American Light & Traction Company, which controls the Jacques Cartier company, denies that the property is involved.

ALUMINUM COMPANY TO INCREASE CAPITAL.—Notice has been filed with the Secretary of State of Pennsylvania by the Aluminum Company of America of an increase of the capital stock of the company to $20,000,000. At present the capital is $600,000 preferred and $3,200,000 common. When asked as to the purpose of the increase one of the officials of the company said: "We have made no plans for extensions or the expenditure of the proceeds of the sale of stock. We have simply applied for the right to increase, but I would not say that we had made any plans for getting any money for the stock."

KINGS COUNTY ELECTRIC LIGHT & POWER COMPANY.—The stockholders of the Kings County Electric Light & Power Company met Nov. 11 and authorized an issue of $5,000,000 of 6 per cent convertible debenture bonds. The proceeds of these bonds are to be used for the acquisition of property, new construction and the improvement of the plant. An application was made some weeks ago to the Public Service Commission for an approval of this issue, and several hearings have been had upon the subject, but no action has as yet been taken.

DOHERTY & COMPANY BUY MARYLAND TRACTION.—Henry L. Doherty & Company have purchased control of the Cumberland & Westernport Electric Railway Company, with headquarters at Cumberland, Md. This road has 26 miles of track and runs from Cumberland to Lonaconing, Md. The company is a consolidation of several small traction properties in that section. It has outstanding $625,000 of stock and $230,000 of bonds. Doherty & Company promise to improve the condition of the property and expect to operate it.

HEAVY EARNINGS FOR BELL COMPANIES.—During the first nine months of the current year the associated Bell operating companies of the United States, not including the long-distance lines, showed gross earnings of $99,834,450, which is an increase of more than 7 per cent over the previous year. The operating expenses and taxes were a trifle more than $40,000,000, and there was charged off $31,271,194 for maintenance and depreciation. The net earnings after all of these charges were $27,448,113.

ATLANTIC CITY GAS COMPANIES SOLD.—Clarence H. Geist, of Philadelphia, has purchased both the Consumers' Gas Company and the Atlantic City Gas & Water Company, which are operated in Atlantic City, the price paid being approximately $3,500,000. Mr. Geist now has a large number of gas enterprises throughout the Middle West, and last August took over the Wilmington Gas & Electric Company. The new owner contemplates extensive improvements in the Atlantic City properties.

SOUTHWESTERN TELEPHONE & TELEGRAPH COMPANY.—H. H. Patterson, Augusta, Ark., has sold his telephone system, consisting of about 100 miles of long-distance lines and local systems at McCrory, Cotton Plant and Augusta, to the Southwestern Telephone & Telegraph Company. The price paid was $25,000. Mr. Patterson retains control of the farmers' lines.

CONSOLIDATED LIGHT COMPANY, OF KANSAS CITY.—The Consolidated Light & Power Company, of Kansas City, has applied to the Council for a renewal of its franchise, which expires next February. The company asks for permission to charge the same rate as at present prevailing for domestic lamps, and to make a sliding scale of from 4 to 9 cents for commercial lighting.

GREAT WESTERN POWER COMPANY BONDS.—Kountze Bros., of New York, and E. H. Rollins & Sons, of Boston, are offering to the public $3,000,000, 5 per cent, first mortgage bonds of the Great Western Power Company of California. These bonds are offered at 96 and interest, yielding the purchaser 5¼ per cent.

DIVIDENDS.

American Railways Company, quarterly, 1½ per cent, payable Dec. 15.

Columbus (Ohio) Railway Company, quarterly, 1¼ per cent, payable Dec. 1.

International Smelting & Refining Company, quarterly, 1½ per cent, payable Dec. 1.

Kings County Electric Light & Power Company, quarterly, 2 per cent, payable Dec. 1.

Mobile Electric Company, preferred, quarterly, 1½ per cent, payable Nov. 16.

Norfolk Railway & Light Company, semi-annual, 2 per cent, payable Dec. 6.

GENERAL NEWS

Construction News.

AUGUSTA, ARK.—H. H. Pattrson, of Augusta, Ark., has sold his telephone system, consisting of 100 miles of long-distance line and the local systems at McCrory, Cotton Plant and Augusta, to the Southwestern Telephone & Telegraph Company, for $25,000. Under the terms of the sale the Southwestern company becomes sole owner of the Patterson lines, with the exception that Mr. Patterson retains control of the farmers lines.

GLOBE, ARIZ.—Plans are being considered for the installation of a hydroelectric power plant at Apache Falls, 30 miles above the Roosevelt dam on Salt River, to furnish electricity in Globe, 35 miles distant. The cost of the plant is estimated at about $600,000. George Hill, J. B. Newman, P. Jones, E. Stewart and George Shanley, of Globe, are interested in the project.

ALAMEDA, CAL.—The Pacific States Telephone Company has notified the Council that it will place all its wires underground in Alameda. It is said that work will begin within 30 days and wires on Oak Street will be the first to be placed underground.

BIG PINE, CAL.—The Buckeye Mining & Smelting Company is reported to be in the market for equipment for a power plant, which will include a 400-hp electric unit, with exciter and other auxiliary apparatus.

CHICO, CAL.—The Sacramento Valley Power Company has secured a franchise for erecting a system for the distribution of electricity in Chico. The company was the only bidder for the franchise advertised by the City Trustees. It expects to have its transmission line extended from Redding and to furnish electrical service in Chico by February, 1910.

LOS ANGELES, CAL.—Plans are being prepared by Col. C. E. Apponyi for harnessing the Colorado River to develop the water power to be utilized to generate electricity for transmission to mining camps of Arizona and Nevada. The plans contemplate the construction of a hydroelectric plant at the first rapids above the head of high water navigation, about 180 miles by river from Needles, Cal., and between Lincoln County, Nev., and Mojave County, Arizona, where water rights have been secured on a strip of five miles at the place where the plant is to be established. It is estimated that the proposed plant will generate at least 30,000 hp. It is proposed to install four successive turbo-generator units, each working under a 50-ft. head. Electricity can be transmitted to Tonopah, Nev., 170 miles distant, and to Prescott, Ariz., a distance of 160 miles, and intermediate points.

MARTINEZ, CAL.—Sealed bids will be received by the Board of Supervisors until Dec. 6, at the office of J. H. Wells, clerk of board, for a 50-year franchise to erect poles and wires over the roads and highways in Contra Costa County, application for which has been made by H. B. Kinney.

MARYSVILLE, CAL.—The Northern Electric Company has practically completed its transmission line between this city and Meridian, a distance of 20 miles. The company expects to be ready to furnish electrical service by the first of the year. It will furnish electricity for operating irrigation and pumping plants.

OAKLAND, CAL.—Owing to the protest of the property owners on Fifth Avenue against the erection of poles along that thoroughfare, between East Twentieth Street and the water front by Great Western Power Company to carry its high-tension transmission wires, the City Council has authorized the Board of Public Works to take action immediately to insure the removal of the poles.

OROVILLE, CAL.—The Oro Water, Light & Power Company is making preparations for the construction of a large power plant at the mouth of Yellow Creek, a few miles south of Butte Creek.

SAN BERNARDINO, CAL.—The City Council has granted the Southern California Edison Company a franchise to erect and maintain transmission lines over and under the county roads and highway in the County of San Bernardino for the distribution of electricity for lamps and motors.

SAN DIEGO, CAL.—Plans are being made by the Pacific States Telephone & Telegraph Company for general improvements to its system in San Diego, including placing its wires in underground conduits, work on which will commence in the near future.

SANTA ROSA, CAL.—Application has been made to the Board of Supervisors by the Cloverdale Light & Power Company, of Cloverdale, Cal., for a franchise to erect poles and wires for the transmission of electricity, also telephone and telephone wires on certain roads in the county. Andrea Sbarboro is president of the company.

SEBASTOPOL, CAL.—The Board of Supervisors has accepted the bid of H. C. Eastman for a franchise to erect transmission lines for the distribution of electricity from Sebastopol to Graton, Forestville, Occidental, Camp, Meeker, Guerneville and other places in the western part of Sonoma County. The amount paid by the company for the franchise was $250.

FORT LOGAN, COL.—Bids will be received until Dec. 14 by Capt. Chase Doster, constructing quartermaster for the construction of a pump house at Fort Logan. Separate bids to be received in the following sections: Construction of building, plumbing, electric light wiring, boilers and appurtenances, air compressors, steam pumps and pipings. Alternate bid for electrical installation, including electric motors, air compressors, pumps, piping, etc. Plans and specifications may be had on application.

NEW CASTLE, COL.—Sealed proposals will be received at the office of J. E. Smith, town recorder, for furnishing and delivering f.o.b. New Castle, Col., machinery and equipment for the proposed municipal electric light plant as follows: Item 1—Steam engine and belts. 2—Alternating-current generator and exciter. 3—Switchboard. 4—Transformers and series lighting equipment. 5—Line material and supplies. Specifications may be obtained from town recorder.

MERIDEN, CONN.—The Meriden, Middletown & Guilford Railway Company has decided to proceed with the final survey for its proposed railway from Durham to North Branford. Work will commence on that section as soon as the survey is completed.

MERIDEN, CONN.—Plans are being considered to organize a company to operate a small electric light plant in the rear of the Cahill Block to furnish electricity for lamps to the merchants in the Cahill Block and possiby to Poli's theatre in Meriden. E. F. Donahue and the M. W. Booth Company are interested in the project.

ST. PETERSBURG, FLA.—Preparations are being made by the St. Petersburg Electric Light & Power Company for the construction of a new generating station which will be driven by a Corliss engine or steam turbines, with turbo jet condensers. The equipment will include boilers, steel stocks, automatic stoker furnaces, pumps, feed water heater, generators, exciters, switchboard apparatus, transformers, converter, lightning arresters, etc.

ATHENS, GA.—The Athens Electric Railway Company has secured control of Barnett Shoals, near Athens, Ga., where it will in the near future develop 4000 hp for electrical transmission to Athens.

MARIETTA, GA.—The underwriters of the bonds of the old Marietta Public Service & Manufacturing Company, operating the Marietta electric and water plants and paper mills, which went into bankruptcy, have reorganized the company. Application has been made for a charter under the name of the Kennesaw Paper Company, with a capital stock of $302,000. H. T. Inman and others are the incorporators. The head office will be located in Atlanta, Ga.

BOISE, IDAHO—Application has been made to the City Council by Dean Perkins, representing eastern and local capitalists, for a franchise for a new suburban electric railway, which will extend from Boise to Kuna, Idaho.

GRANGEVILLE, IDAHO.—Plans are being made for the construction of a large hydroelectric power plant in Central Idaho, for which purpose, it is said, a company is now being organized to be capitalized at $6,000,000 by capitalists of Spokane, Wash. A. W. Trine, 1815 Boone Avenue, and G. F. LaFrenz, 1632 Elm Street, Spokane, Wash., are said to have located a site for a dam and power plant on the Salmon and Snake rivers, about 40 miles south of Grangeville, Idaho. The plans call for a combination tunnel and dam, which will develop 280,000 hp. The dam will be 100 ft. high and located on the Salmon River about one-quarter of a mile from the point where the tunnel will leave the waterway for the Snake River. The tunnel will be built through solid rock, seven and one-half miles in length, and it is estimated that a fall of 530 ft. will be secured. Water rights for 8000 second ft. of water have been secured on the Salmon River and 2800 second ft. on the Snake River side. R. J. Zell, of Spokane, Wash., engineer, is preparing plans and estimates for the proposed plant.

SHOSHONE, IDAHO.—The Southern Idaho Telephone Company has secured a franchise to erect telephone lines over various roads in Lincoln County.

SHOSHONE, IDAHO—The Great Shoshone & Twin Falls Water Power Company has been granted the right of way for its transmission lines over certain roads in Lincoln County.

GRANITE CITY, ILL.—The National Enameling & Stamping Company, of New York, N. Y., is reported to be contemplating the construction of an electric light and power plant at its stamping works in Granite, Ill, to cost about $30,000. O. B. Niedringhaus is superintendent.

HOMER, ILL.—The Homer Telephone Exchange has been purchased by J. H. Culver, of Decatur, Ill., one of the largest stockholders of the Douglas County Telephone Company, with headquarters at Tuscola, Ill. The Homer exchange will probably be absorbed by the Douglas County system, which operates from 12 to 15 exchanges in Douglas and adjoining counties. It is understood that the local exchange will be rebuilt.

JOLIET, ILL.—The Chicago, Blue Island & Joliet Electric Railway Company has filed a mortgage in the office of the county recorder in favor of the American Trust & Savings Bank to secure a bond issue of

$500,000. The company was recently organized to construct an electric railway to connect the Chicago & Southern with the Joliet & Southern roads, near Frankfort. Work will commence on construction of the road immediately. W. H. Conrad is president, and W. H. Merrill, secretary.

OTTAWA, ILL.—The Northern Illinois Light & Traction Company has applied to the City Council for a renewal of its franchise for a term of 20 years.

ROBINSON, ILL.—The capital stock of the Southeastern Illinois Long Distance Telephone & Telegraph Company has been increased from $30,000 to $50,000.

BREMEN, IND.—A company is being organized to construct an electric railway from Bremen to Milford Junction, 14 miles in length, to connect with the Winona line. The company will furnish both a passenger and freight service, and will also furnish electricity for lamps and motors along the route of the railway.

BUCK CREEK, IND.—The Eckert Telephone Company is in the market for a new switchboard and exchange equipment to replace the loss of similar equipment by fire.

FRANKFORT, IND.—It is reported that the Great Western Smelting & Refining Company, of Chicago, Ill., has decided to reopen and put in operation the Frankfort Brass Works, which has been in the hands of a receiver for a year or more. The plant will be operated by electricity. The new company has applied to city for rates for electrical service, and if satisfactory arrangements are made, it is said that the plant will be started by Dec. 1.

INDIANAPOLIS, IND.—The Peacock-Woolley Company, of Chicago, Ill., has withdrawn its offer to install a free lighting system in the down town district in consideration of the advertising privileges on the lamps. As a result the City Council will proceed with a plan to install a large number of arc lamps suspended from poles heavier than are now used to support street lamps and trolley wires, at a cost of about $14,000.

INDIANAPOLIS, IND.—The Shore Line Traction Company has been granted a franchise by the Commissioners of Marion County for the construction of an electric railway in Churchman's Pike, from Indianapolis to Beach Grove, a distance of nine miles. The company, it is said, has not yet decided whether it will seek an independent entrance into Indianapolis and build a power house at Beach Grove. Louis McMains is interested in the project.

JASONVILLE, IND.—The Indiana Electric Transmission Company, of Terre Haute, Ind., has issued bonds to the amount of $70,000, the proceeds to be used for the installation of a water works system in Jasonville.

LOGANSPORT, IND.—The Commissioners of Cass County have granted the Indiana & Northwestern Traction Company a 75-year franchise to construct an electric railway through the county.

NEW ALBANY, IND.—The Board of Public Works has rejected the bid submitted by the United Gas & Electric Company for furnishing electricity for street lighting for a term of ten years, beginning Sept. 1, 1910.

NEW CASTLE, IND.—The New Castle Independent Telephone Company is asking for an extension of franchise for 50 years. The present 12-year franchise will expire next year. The company promises in case of an extension to make extensive improvements and extensions to its system.

SOUTH BEND, IND.—The City Council has ordered the Central Union Telephone Company, which is building a new exchange here, to proceed with the construction of its underground system.

TERRE HAUTE, IND.—The Indiana Electric Transmission Company, of this city, has amended its charter so as to enlarge its field of corporate operation, enabling the company to extend its system to any county in the State. Thomas Duncan is president.

COIN, IA.—The citizens of Coin are considering the question of installing an electric lighting system, water works and sewers.

PELLA, IA.—The City Council has engaged the Iowa Engineering Company to supervise the installation of the municipal electric light plant and water works system.

WATERTOWN, IA.—The Village Board has granted the United Light & Power Company, of East Moline, Ill., a 25-year franchise to furnish electricity for lamps and motors in Watertown. Under the terms of the franchise the village is given the privilege of purchasing the plant and equipment at the expiration of the franchise. The company agrees to furnish arc lamps for street lighting at the rate of $70 each per year on all lamps under 25; all over that number will be supplied at the rate of $65 per lamp per year.

EMPORIA, KAN.—Negotiations are under way between the Emporia Business Men's Association and the Anderson Electric Light Company in connection with the company locating in Emporia. The company wishes to locate in this city and is seeking inducements. It is understood that the company will erct a building at a cost of $10,000 and install a $5,000 plant.

ERIE, KAN.—At a special election held Nov. 2 the citizens voted to issue $50,000 in bonds, the proceeds to be used for the construction of a combined electric light and water works system.

GREENLEAF, KAN.—A movement is on foot for the installation of an electric light plant in Greenleaf.

MINERAL, KAN.—The City Council has granted Henry Arnold & Company a franchise to construct and operate an electric light plant in Mineral.

NICKERSON, KAN.—At an election held Nov. 2 the citizens defeated the proposition to issue $35,000 in bonds for the construction of an electric light plant and water works system.

WAVERLY, KAN.—Extensive improvements will be made to the municipal electric light plant, which will include the installation of complete new power equipment, consisting of engine, generator, boiler, pump feed water heater, exciter, etc. The machinery, it is said, will be purchased by Dec. 1.

NEWPORT, KY.—The Board of Aldermen has authorized the Citizens Telephone Company to install and operate a telephone system in Newport.

PLAQUEMINE, LA.—The power plant of the municipal electric light plant and water works system was destroyed by fire on Nov. 1. The town at present is without lighting facilities. Temporary arrangements have been made with the Wilberts Sons Lumber & Shingle Company to supply water to the town.

PORTLAND, MAINE.—The contract for installing special electric fixtures in the new county building, bids for which were opened Nov. 1, was awarded to the McKenney & Waterbury Company, of Boston, Mass., for $12,342.

FREDERICK, MD.—Negotiations have been closed whereby the Chesapeake & Potomac Telephone Company has purchased the plant and holdings of the Frederick County Telephone & Telegraph Company. The consideration is said to be about $125,000,

STILL POND, MD.—Plans are being considered by Rev. John H. Beauchamp and Barnard Harper, of Still Pond, for the establishment of an electric plant at Urieville, Md., to furnish electricity for lamps in Still Pond, Betterton, Kennedyville and Lynch. The cost of the plant is estimated at $12,000.

THURMONT, MD.—The Citizens Electric Light & Power Company, recently incorporated, is reported to have awarded a contract for the construction of power house and furnishing equipment to cost $16,015. The plant will be located on Hunting Creek, near Thurmont. John R. Rouzer, Morris A. Birley and others are interested in the company.

SOUTH BARRE, MASS.—The new mill building of the Nornay Worsted Company, of Providence, is expected to be completed by Dec. 1. The machinery will be operated by electricity, which will be generated by the company's own plant.

WORCESTER, MASS.—The Worcester Consolidated Street Railway Company has closed its power plant on Brigham Street, Westboro. The plant will be dismantled and the equipment placed in the Westfield power station on the Woronoco Street Railway.

ALPENA, MICH.—Prof. D. W. Mead, of University of Wisconsin, Madison, Wis., is reported to have completed plans for the construction of a large hydroelectric power plant on Thunder River for the Alpena Power Company, of Alpena, Mich.

BAY CITY, MICH.—The Chippewa Power Company has withdrawn its application for a franchise to furnish electricity in Bay City, advising the committee that it could not accept the rates that the committee proposed in the franchise which was to be submitted to a vote of the people. The city owns and operates a municipal electric light plant. The rates demanded by the committee were seven cents per kw-hour for 100 kw or less; five cents per kw-hour from 100 to 150 kw and four cents for all used above 150 kw. The company offered to furnish electricity at the rate of eight cents per kw-hour for 100 kw or less and all in excess of that for five cents per kw-hour. W. F. Davidson, of Port Huron, Mich., is vice-president of the company.

HEMLOCK, MICH.—The Wilsterman Electric Company is reported to have secured the contract for the installation of the new power plant in Hemlock; also the contract for commercial wiring.

TRAVERSE CITY, MICH.—Plans are being prepared by the Traverse City Refrigerator Company for the construction of a new plant in Traverse City. The equipment will include steam boilers and motor-driven blowers for the refuse disposal system.

AURORA, MINN.—The Village Council is considering the question of establishing a municipal electric light plant.

GRANITE FALLS, MINN.—The question of purchasing a new water wheel for the municipal electric light plant is reported to be under consideration.

WHITE BEAR, MINN.—The Washington County Light & Power Company of Stillwater, Minn., is reported to have acquired the electric plant of the White Bear Company. It is said that the local steam plant will be abandoned and electricity for operating the system will be furnished from the power plant in Stillwater, Minn.

ACKERMAN, MISS.—The contract for construction of the municipal electric light plant and water works system is reported to have been awarded to Walton & Wegner, of Atlanta, Ga. X. A. Kramer, of Magnolia, Miss., is engineer.

GULFPORT, MISS.—Sealed proposals will be received by the Mayor and Board of Aldermen until Dec. 7 for one direct-connected, two-stage turbine centrifugal pump and motor, pump to have a capacity of 1500 gal. per minute, under 100 lb. pressure, speed not to exceed 1200 r.p.m.; motor to be alternating-current type, three phase, 60 cycles. Also one

constant duty, single suction volute pump, having a capacity of 350 gal. per minute, under 25 lb. hydraulic pressure. Pump and motor to be direct connected; motor to be alternating-current type, three-phase, 60 cycles, 220 volts, speed not to exceed 900 r.p.m. Specifications and blank forms of proposals may be obtained from the city engineer. Proposals to be addressed to N. D. Goodwin, city clerk.

TYLERTOWN, MISS.—The Cumberland Telephone Company has been granted a franchise to erect a telephone system in Tylertown.

TYLERTOWN, MISS.—The Pike County Lumber Company has applied for a charter with a capital stock of $150,000 for the purpose of engaging in a lumber business. The company also ask for the privilege of operating railroads, light and water plants and other utilities necessary to conduct a lumber manufacturing business. R. H. Cline, A. W. Cline, R. P. Holmes and R. S. Holmes, all of Hattiesburg, Miss., are incorporators.

ASH GROVE, MO.—The question of establishing an electric light plant in Ash Grove is under consideration.

KANSAS CITY, MO.—The Consolidated Light & Power Company has applied to the City Council for a renewal of its franchise, which expires Feb. 20, 1910. The company asks for permission to charge the same rate for electricity for domestic lamps and a sliding scale of from four to nine cents per kw-hour for commercial lighting.

ST. LOUIS, MO.—The Kansas City & St. Louis Electric Railway Company, which proposes to construct an electric railway from St. Louis to Kansas City, has increased its capital stock from $5,000,000 to $15,000,000. D. C. Nevin is president of the company and H. E. Insley, secretary and treasurer.

ST. LOUIS, MO.—The Light & Power Development of St. Louis has renewed its application for a 30-year franchise to enter into competition with the Union Electric Light & Power Company to furnish electricity in St. Louis. The Light & Development Company owns and operates the Cape Girardeau Light & Power Company, Cape Girardeau, Mo., and is operating the Paris Electric Light & Power Company, of Paris, Tex., and also the Paris Transit Company, of the same city. The company also operates light and power plants in the Wright and Chemical buildings. and the plant in the Famous and old Grand Leader buildings in St. Louis.

DILLON, MONT.—Plans are being prepared by the Montana Independent Telephone Company to install a system in Dillon. The company will also erect cross-country telephone lines from Butte to Twin Bridges, Sheridan and Virginia City to connect with Dillon.

LINCOLN, NEB.—The committee appointed by the City Council to investigate the municipal electric light plant has recommended the installation of an additional 500-hp engine and generator and other equipment to increase the output of the plant to meet the increased demands made upon it. The cost of the work is estimated at about $40,000.

VALENTINE, NEB.—Bids will be received at the office of the village clerk until Nov. 29 for the construction of the whole or parts of the water and lighting systems of the proposed municipal electric light and water systems, including furnishing and installing of all machinery and apparatus in accordance with plans and specifications prepared by the W. K. Palmer Company, engineers, Kansas City, Mo. Specifications are divided into seven different sections and bidders are invited to submit bids for any or all sections or for the system complete as follows: Section 1—Earth dam and spillway. Section 2—Wells complete ready for equipment. Section 3—Concrete reservoir, power house, wheel pit and pump house. Section 4—Pole line equipped complete. Section 5—Water mains and distributing system. Section 6—All power equipment, installed complete. Section 7—Tank and tower (Alternative for concrete reservoir in section 3). Plans and specifications are on file at the office of the village clerk and at the offices of the W. K. Palmer Company, engineers, Dwight Building, Kansas City, Mo. Copies of complete plans will be furnished by the engineers upon payment of $5 to cover cost of preparation; sections 3, 5 or 6 for $2 each, and $1.50 for sections 1, 2, 4 or 7.

YORK, NEB.—The York County Independent Telephone Company has decided to increase its capital stock by $50,000.

CARSON CITY, NEV.—It is reported that the construction of a large power plant in Mono County is under consideration. J. S. Cain, president of the Mono County Bank and the Cain & Comstock Mining & Milling Company is interested in the project.

RENO, NEV.—Surveys have been completed for the construction of an electric railway connecting Ely, East Ely, Smelter, Ripetown and the mines at Ely. The cost of the railway is estimated at about $300,000. Work on construction of the road will soon commence. G. L. Rickard is president.

NEWARK, N. J.—The contract for the installation of the new electric light plant at the jail was awarded to Storms & Company, of Newark, N. J., for $10,478.

BINGHAMTON, N. Y.—The Board of Managers of the Binghamton State Hospital has submitted recommendations to the State Commission in Lunacy asking the commission to petition the State Legislature for $150,000 for improvements for the hospital, of which $55,000 is asked for the construction of a new lighting plant.

BROOKLYN, N. Y.—Bids will be received by Nicholas J. Hayes, fire commissioner, at his office, 157 and 159 East Sixty-seventh Street, New York City, until Nov. 23 for furnishing and delivering 21,000 ft. of underground lead covered cable for fire alarm telegraph. Blank forms and further information may be obtained at the above office.

BROOKLYN, N. Y.—All contracts for the construction of the Fourth Avenue Subway in Brooklyn, have been signed and work will soon commence on construction of the same. The Edison Electric Illuminating Company of Brooklyn has asked the Public Service Commission for permission to furnish electricity for lighting and operating the whole or part of the proposed subway.

CENTER MORICHES, N. Y.—The citizens of Center Moriches have petitioned the Town Board for permission to form a street lighting district.

DUNDEE, N. Y.—Negotiations have been closed between the Village President and E. L. Bailey, owner of the Dundee electric light plant, for substituting the present incandescent street lamps of 25 cp for 80-cp tungsten lamps, which will give the village a much better service at an additional cost of $300 per year, making the total cost $1,800 per year. The new lamps will be installed at once.

FLORIDA, N. Y.—The Public Service Commission has authorized the Orange & Rockland Electric Company, of Monroe, N. Y., to construct and operate an electric light system in the village of Florida, and has also approved of the franchise granted to the company by the Town Board of Warwick. The company furnishes electrical service in Monroe and other towns in Orange County.

GOUVERNEUR, N. Y.—Preparations are being made by the Oswegatchie Light & Power Company for the construction of an electric power plant in Hailesboro, two miles distant, on the site of mill No. 5, next spring. The water has a natural fall of 25 ft., to which will be added a 7-ft dam, which will develop over 3000-hp. Electricity will be transmitted from Hailesboro to Gouverneur.

LITTLE FALLS, N. Y.—Preparations are being made by the Utica Gas & Electric Company, of Utica, N. Y., for the construction of a hydroelectric plant to be erected on the "Old Lovenheim Mill site" at Little Falls, N. Y., at a cost of about $100,000. H. W. Dennis, of Niagara Falls, N. Y., is engineer. N. J. Brayton, of Utica, is president of the company.

MINEOLA, N. Y.—The New York & North Shore Traction Company has purchased a site on Alley Creek, Bayside Meadows, where it proposes to erect a power plant. Electricity generated at this plant will be utilized to operate the new railway extending from Whitestone Landing to Flushing, and the railway connecting Nassau and Queens counties.

NEW YORK, N. Y.—The Board of Estimate has approved the plans of the White Plains Avenue extension to the Westchester Avenue subway route.

NEW YORK, N. Y.—The Public Service Commission, First District, has granted the South Shore Traction Company permission to construct its railway through Queens Borough and across the Queensboro Bridge.

NEW YORK, N. Y.—Preparations are being made to improve the lighting systems in the parks, which will include the installation of about 1500 tungsten lamps of 60 cp to replace 400 or more gasoline lamps now in service. New lamps will also be provided for Prospect Park, in the Borough of Brooklyn. Henry Smith is park commissioner.

NIAGARA FALLS, N. Y.—The Niagara Falls Hydraulic Power & Manufacturing Company has installed another 10,000-hp unit in its plant, making the seventh unit in the station. Contracts have already been placed for the additional output.

PAINTED POST, N. Y.—The Corning Cut Glass Company has installed an engine and dynamo in its plant to generate electricity for lighting its factory.

TALCVILLE, N. Y.—The dam and power house of the Uniform Fibrous Talc Company, located near Talcville, is nearly completed. The plant will furnish electricity to operate the new talc mine and mill of the company. Connell & Connell, 90 West Street, New York, N. Y., are engineers.

ALBEMARLE, N. C.—Local cotton mills are reported to have closed a contract with the Southern Power Company to supply electricity for operating several textile mills in Albemarle. The town recently voted to issue bonds to install an electric lighting system. It is now thought possible that a contract may be made with the Southern Power Company to supply electrical energy to operate the same.

CANTON, N. C.—Mr. McCormick, of Chicago, Ill., is reported to be interested in a project to construct an electric railway to connect Asheville and Waynesville, for which surveys have already been made. It is understood that the railway will leave the Southern Railway at Canton and follow up the Pigeon River and through the Davis Gap route to Waynesville.

HICKORY, N. C.—The Southern Power Company is reported to be considering extensive developments on the upper Catawba River, near Hickory, including the erection of another transmission line, surveys for which will soon be made. The company already has a contract to furnish electricity in Hickory.

FORT LINCOLN, N. D.—The contract for electric wiring and installing electric fixtures in buildings at Fort Lincoln was awarded to the Electric Construction Company, of St. Paul, Minn., for $24,998. J. D. Elliott is constructing quartermaster.

GRAND FORKS, N. D.—It is reported that the ways and means committee of the City Council has recommended holding an election to

vote on the proposition to issue $141,000 in bonds, of which $25,000 will be utilized to increase the output of the municipal electric light plant.

COLUMBUS, OHIO.—The Columbus & Cincinnati Air Line Traction Company is making preliminary surveys for its proposed electric railway to connect Columbus and Cincinnati, a distance of about 100 miles. The Riggs & Sherman Company, of Toledo, Ohio, are engineers. For further information address W. J. Sherman, of Toledo, Ohio.

COLUMBUS, OHIO.—Bids will be received until Dec. 10 by the Board of Managers of the Ohio Penitentiary for power equipment in accordance with specifications prepared by Marriott & Allen, architects, 20 East Broad Street, Columbus, Ohio, and the Osborn Engineering Company, engineers, Osborn Building, Cleveland, Ohio, from whom plans and specifications can be secured. The equipment will include two direct-connected units consisting of alternating-current generators and cross compound Corliss engines, turbo-generators, two boiler-feed pumps, one feed-water heater, one electric traveling crane and four automatic stokers. Bids must be made on blank forms, which will be furnished on application to the architects or engineers. George U. Marvin is secretary.

FOSTORIA, OHIO.—We are advised that the Fostoria & Fremont Railway Company will commence work on construction of its proposed electric railway, which is to extend from Fremont and Fostoria, a distance of 21.4 miles, within 30 days. The company has taken over the property of the Fremont City Street Railway, now in operation between Fremont and Ballville, 2.5 miles in length, which will be used for an entrance to Fremont. It is expected to have the railway completed by July, 1910.

SHARON, OHIO.—Plans are being considered by the Mercer County Telephone Company for extensive improvements to its entire system throughout Mercer and Lawrence counties which will involve an expenditure of thousands of dollars. The present plans contemplate the erection of a telephone exchange in Sharon and the installation central energy system. The lines in Mercer County will be reconstructed first.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company, it is reported, will be in the market for power equipment for its new plant, including condensers, pumps and electrical apparatus. The company has already placed some orders in connection with its new power station to be erected this winter.

WILLSHIRE, OHIO.—The Willshire Telephone Company has received authority from the Secretary of State to increase its capital stock from $20,000 to $35,000.

APACHE, OKLA.—The City Council has engaged the Southwestern Engineering Company, of Oklahoma City, Okla., to prepare plans for the construction of an electric light plant and water works and sewer systems. The proposition to issue $54,000 in bonds for construction of the improvements will be submitted to a vote. H. Peeper is mayor.

CHEROKEE, OKLA.—The City Council has called for an election to vote on the proposition to issue $30,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system.

DURANT, OKLA.—The citizens are reported to have voted to issue $50,000 in bonds, part of which will be used to establish an electric light plant.

EL RENO, OKLA.—The contract for the completion of the interurban railway of the El Reno Interurban Railway Company from El Reno to Yukon has been awarded to the Adams Construction Company. It is said that most of the right of way from Enid to this city has been secured.

LEXINGTON, OKLA.—The Oklahoma City, Lexington & Sulphur Springs Electric Railway Company has submitted a proposition to the citizens of Wynnewood to extend its proposed electric railway through Wynnewood, on condition that the people of the town subscribe to $25,000 in capital stock. The proposed railway will extend from Oklahoma City to Sulphur. James Sherman, of Lexington, is president.

POTEAU, OKLA.—The Poteau Electric Light & Ice Company is reported to have engaged H. L. Nichols & Company, engineers, of Muskogee, Okla., to prepare plans for its proposed electric light plant, water works system and ice manufacturing plant.

RALSTON, OKLA.—M. A. Earl & Company, of Muskogee, Okla., have been engaged to prepare plans and take charge of the construction of the proposed municipal electric light plant and water works systems for Ralston.

BEND, ORE.—Application has been made to the City Council by Louis Doonar, vice-president and general manager of the Pioneer Telegraph & Telephone Company, for a franchise to construct and operate an electric plant in Bend to furnish electricity for lamps and motors. If granted a franchise Mr. Doonar agrees to begin work on the plant within 90 days.

MEDFORD, ORE.—C. E. Sharpe is reported to have been granted a franchise to erect a telephone system in Medford.

PRINEVILLE, ORE.—Plans are being made for the construction of an electric railway from Opal City, the new town on the north side of Crooked River to Prineville, via Lamonta Gap and McKay flat. Electricity for operating the railway will be generated at Oden Falls, where the power plants will be located. Contracts have been awarded for the construction of the power plant.

WALLOWA, ORE.—Preparations are being made by the Home Telephone Company to erect a telephone line to Lower Valley. The company will also install a copper circuit on the main line from Le Grande to Joseph.

ALIQUIPPA, PA.—The Jones & Laughln Steel Company, which is erecting a new plant in Aliquippa, will equip its plant for electric motor drive. It is said that the company will soon place orders for electrical equipment amounting to over $100,000.

BEAVER FALLS, PA.—The Beaver Valley Traction Company has decided to make improvements to its power house and storage battery equipment, which will involve an expenditure of about $10,000.

FREIDENSBURG, PA.—The Pinegrove & Cresonna Telephone Company contemplates extending its telephone lines to Friedensburg by the way of Black Horse.

INTERCOURSE, PA.—We are informed that work will commence immediately by the Intercourse Electric Light, Heat & Power Company on the extension of its transmission lines to Leaman Place, Paradise and Gordonville, a distance of three miles, for the purpose of furnishing electrical service in those towns. The cost of the work is estimated at $3,000. Emos L. Zimmerman is interested in the company.

JOHNSTOWN, PA.—The Johnstown & Altoona Street Railway Company has completed arrangements for the sale of $1,500,000 in bonds. It is said that work will commence on construction of the railway in the spring.

LEBANON, PA.—It is reported that the American Iron & Steel Manufacturing Company is planning to erect a steel billet mill in Lebanon in the near future, which will involve an expenditure of about $500,000. Announcement has been made that steel billets will be manufactured by an electrical process.

PHILADELPHIA, PA.—The Councils have passed the ordinance providing for the erection of 171 additional electric lamps on Market Street, between Second and Sixteenth streets. It is expected that the Council will authorize the installation of additional lamps in Walnut and Chestnut streets and around Independence Hall and Independence Square. The cost of additional lamps on Chestnut and Walnut streets is estimated at $55,000. It is said that action on the Market Street lighting project was due to the fact that the Philadelphia Electric Lighting Company has voluntarily assumed the cost, which is estimated at $30,000, of erecting the ornamental posts on which the new lamps are to be placed, contract for which has already been placed by the company in accordance with the designs prepared by Chief McLaughlin of the Electrical Bureau.

PITTSBURGH, PA.—Arrangements are being made by the Pittsburgh Railways Company for improvements and extensions to its system, which will include the installation of a 2000-hp motor generator, order for which has been placed with the Westinghouse Electric & Manufacturing Company. Orders have also been given to the same company for 240 motors of 100 hp each. The company is building a new subdivision power house on the Castle Shannon line near the south end of the Mt. Washington tunnel.

PITTSBURGH, PA.—The ordinance authorizing a contract for lighting the streets of the city by electricity for a period of not exceeding three years, to cost not more than $325,000 per year, has been recommended to the Council by the public works committee. The ordinance on the incandescent mantle lighting on some of the streets and alleys was amended to provide for either mantle or electric lamps, not to exceed an expenditure of more than $100,000 per year and the contract not to extend over a period of more than three years.

UNIONTOWN, PA.—A franchise has been granted to William A. Stone to construct and operate an electric railway in Uniontown.

WARREN, PA.—Plans are being considered by the Warren & Jamestown Street Railway Company for extending its railway from Jamestown to Dunkirk, passing through Ellicott, Gerry, Ellery, Stockton, Charlotte and Pomfret.

ANDERSON, S. C.—The Anderson Water & Light Company is sinking 60 additional wells for the purpose of increasing its water supply.

BEAUFORT, S. C.—At an election held Nov. 4 the citizens voted in favor of the proposition to issue bonds for the construction of an electric light plant and water works system. A board of commissioners, consisting of W. F. Marscher, W. J. Thomas and R. A. Long, was appointed to sell the bonds and to construct the plants and operate them.

CAMDEN, S. C.—The city would like to correspond with parties interested in a franchise for an electric lighting system. For further information address the mayor.

GREENVILLE, S. C.—The transmission lines of the Southern Power Company, from the power station at Great Falls to the new substation at Greenville, which were to have been completed two months ago, will not be ready before Dec. 1. The company will furnish electricity for operating the Monaghan and Woodside cotton mills.

HARTSVILLE, S. C.—At an election to be held Nov. 23 the citizens will vote on the proposition authorizing the Hartsville Electric & Water Company to construct an electric light and power plant.

ABERDEEN, S. D.—The plant and holdings of the Aberdeen Electric Light & Power Company are reported to have been sold to the Union Company, of Omaha, Neb. It is said that improvements will be made to the system and additional equipment installed, which will involve an expenditure of about $100,000.

CENTERVILLE, S. D.—The South Dakota Interurban Railway Company, which proposes to construct an interurban railway from Sioux Falls to Bijou Hills, 160 miles in length, announces that a survey has been made as far as Parkston, which town has donated $50,000 for the railway. Right of way has been secured as far as Freeman and, it is

said, that fully a third of the money required to promote the project has already been subscribed. W. E. Miller is president of the company.

MILBANK, S. D.—Work is progressing rapidly on the construction of the new electric light plant in Milbank. The company expects to have the plant in operation by the middle of December. The wires will be placed underground in Main Street.

SPRINGFIELD, S. D.—Bids will be received by the regents of education of the State of South Dakota for furnishing and installing equipment for an electric lighting plant at the State Normal School, at Springfield, S. D., according to plans and specifications now on file at the office of the State Normal School, Springfield, S. D., the office of Regent T. W. Dwight, Sioux Falls, S. D., and the office of Chairman A. E. Hitchcock, Mitchell, S. D. E. C. Ericson is president.

BRISTOL, TENN.—The Bristol Gas & Electric Company is reported to have made arrangements with another corporation for the construction of a hydroelectric plant, at a cost of about $250,000, to increase its present output and to provide for future demands. Electricity will be transmitted to a substation near the city for distribution for lamps, heat and motors. It is understood that work will soon commence on construction of the plant and will be completed about July 1, 1910.

OBION, TENN.—The question of issuing $30,000 in bonds for construction of an electric light and water works system is under consideration and will be submitted to a vote.

RICHARD CITY, TENN.—Preparations are being made by the Dixie Portland Cement Company to equip its machinery for electric motor drive, using direct-current motors.

ELGIN, TEX.—It is reported that K. F. Leggett, of Livingston, Tex., is contemplating the installation of an electric light and ice plant. A conditional franchise has been granted to Mr. Leggett to establish an electric plant.

GALVESTON, TEX.—The Galveston-Houston Electric Railway Company, which contemplates the construction of an electric interurban railway connecting Galveston and Houston, a distance of 45 miles, will build the road entirely on private right of way. The main power house will be located in Texas City on the water front of Galveston Bay, about three miles from the main line of the railway. The initial installation will include two turbo-generators rated at 1000-kw and 500-kw, respectively. The railway will be operated by a 600-volt, direct-current overhead trolley system, using catenary suspension; electricity will be provided from four substations located about 10 miles apart. Plans as yet have not been prepared, or any time set for receiving bids for equipment. In Galveston the company will operate over the tracks of the Galveston Electric Company, a distance of about three and one-half miles, and at Houston over the tracks of the Houston Electric Company for about the same distance.

ROSCOE, TEX.—The Roscoe, Snyder & Pacific Railway Company has placed a contract with the Balsh Brothers, of Hermleigh, Tex., for the erection of about 50 miles of telephone and telegraph line between Roscoe and Snyder. The line will be used exclusively by the railroad company and for the present will be used for telephone service only.

MANTI, UTAH.—The Manti Light & Power Company has filed application with the state engineer for 10 cu.-ft. of water per second in Manti Creek in Sanpete County, to be utilized to generate electricity. The plant will be equipped with Pelton water wheels 60 in. in diameter to be operated under a head of 444 ft. The plant will develop about 430 hp. Electricity generated at the plant will be utilized for lamps and motors in Manti and other towns in this vicinity.

MARYSVILLE, UTAH.—Application has been made to the State engineer by H. E. Smith, of Duluth, Minn., asking for 100 cu. ft. per second of the flow of the Sevier River on Piutte County, to be utilized for power purposes. The application states that the diverting works will consist of a dam about 16 ft. high across Sevier River and a diverting channel 42,000 ft. long. The power plant will be equipped with 72-in. Pelton water wheels operating under a 330-ft. head. It is estimated that 1500 hp can be developed. Electricity generated at the plant will be transmitted to Marysville, Kimberly, Richfield, Milford, Frisco, Sevier and intermediate points.

SALT LAKE CITY, UTAH.—The Salt Lake & Ogden Railway Company has commenced work on the construction of its power station at Lagoon, which with equipment complete, will cost about $200,000. The company will erect substations costing $25,000 each at Stockdale, Lagoon, Clearfield and Ogden.

SALT LAKE CITY, UTAH.—Application has been made to the State engineer to impound 615 acre-ft. of water to be obtained from the flow of North Dry Creek in Salt Lake County. The plans call for the construction of four dams, intake works, flume, pipe, reservoirs, gates and spillways. The plant to be erected will operate under a head of 2145 ft. and, it is said, will be located at a point south of Little Cottonwood Canyon. The proposed plant will furnish electricity for lamps and motors in Salt Lake, Bingham, Canyon, Garfield, Alta, Park City and other places in Utah.

SALT LAKE CITY, UTAH.—Samuel Russell, of Salt Lake City, has filed a notice of appropriation of 25 cu. ft. of water per second of the flow of Little Cottonwod Creek in Little Cottonwood Canyon, the water to be utilized to generate electricity, which will be distributed throughout Salt Lake County for lamps and motors. The diverting channel will be 6000 ft. in length and will carry water under a head of 500 ft. to 60-in. Pelton water wheels. It is estimated that 1100 hp can be developed.

SALT LAKE CITY, UTAH.—Application has been made to the State engineer by L. B. Spencer of Salt Lake City for two water rights in South Fork Canyon, to be utilized to generate electricity to be transmitted to Huntsville, Ogden, Salt Lake City and other towns. One of the applications asks for 20 cu. ft. per second of the flow of the South Fork of the Ogden River.

WOODSTOCK, VT.—The Woodstock Electric Company has filed a certificate with the Secretary of State of an increase in capital stock from $22,000 to $40,000.

DANVILLE, VA.—The Dan River Power & Manufacturing Company is contemplating the installation of a centrifugal pump direct connected to an induction motor for circulating feed water at its plant.

FORT MEYER, VA.—Contracts have been awarded by W. W. Whitside, constructing quartermaster, for the installation of an electric lighting system at Fort Meyer, Va., as follows: Wiring buildings for electric lighting, installing watt meter connections, furnishing and installing fixtures in buildings, to J. F. Buchanan & Company, Philadelphia, Pa., for $14,788; constructing underground conduit system, with all manholes and junction boxes, etc., to McCay Engineering Company, Baltimore, Md., for $8,500; constructing underground and aerial system of transmission and service lines, complete street lighting system, poles, brackets, etc., to McCay Engineering Company, Baltimore, Md., for $14,000; for furnishing and installing all tungsten lamps and apparatus for basement of building No. 8, to the National Electric Supply Company, Washington, D. C., for $466.

POTOMAC, VA.—The Town Council has granted the Alexandria Electric Light & Power Company a 30-year franchise to construct and operate an electric lighting system in Potomac. The Council also authorized the Mayor to enter into a contract with the company to furnish 44 incandescent lamps for lighting the streets of the town.

RICHMOND, VA.—The committee on electricity has adopted the report recommended by E. W. Trafford, consulting engineer, for additional excavations to provide for possible future enlargements to the municipal electric plant. The proposition for excavating for an additional tail race and to provide for an additional wheel chamber, which would allow the installation of an additional generator later, has not been acted upon by the committee. Bids have been received by the committee for the condenser system for the plant and for the steam and water piping, the boiler feed pump and heater, but owing to the delay in furnishing some contractors with blue prints, it was decided to return the bids unopened and to call for new proposals to be opened Nov. 22.

WINCHESTER, VA.—The Winchester & Washington City Railway Company, which is preparing to construct an auxiliary steam-generating plant in Millville during the coming year, expects to have plans and specifications ready to ask for bids for construction of the plant about Jan. 1, 1910. It is expected to have the plant completed by June 1 so as to provide energy for its system during the summer months. A consulting engineer will soon be selected to take charge of constructing the plant. The company now operates a hydroelectric plant on the Shenandoah River. D. M. Swink is superintendent.

ENTAIT, WASH.—The Gullage tract, consisting of 225 acres, at the mouth of the Entait River, has been purchased by Charles Gray and associates, where they propose to build a dam and erect a power plant to furnish electricity to operate a proposed electric railway to extend from Douglas to Waterville.

KENT, WASH.—Arrangements are being made to form a company for the purpose of raising $100,000 and securing the right of way for constructing an electric railway from Kent to Renton, where it will connect with the Seattle, Renton & Southern Railway. The proposed railway will be seven miles in length and will cost about $100,000. Thomas Chapman, of O'Brien, Wash., and Henry Madison, of Kent, Wash., are interested in the enterprise.

OAKVILLE, WASH.—The City Council has granted to W. A. Shoemaker a franchise to construct and operate an electric light plant and water works system in Oakville, Wash.

SPOKANE, WASH.—The Washington Water Power Company has applied to the City Council for a franchise for an extension of its railway on several streets in Spokane.

SPOKANE, WASH.—The Yakima Valley Power Company has filed application with the State land office for a right-of-way across shore lands in Grant County.

CLARKSBURG, W. VA.—Plans are being considered by the United States Aluminum Company for the construction of a plant in Clarksburg, W. Va., which will be equipped for electrolytic refining, similar to its plant in Massena, N. Y. The equipment, it is said, will include direct-current generators, with extra wide commutators, and other apparatus.

KENOSHA, WIS.—The Cooper Underwear Company, of Kenosha, Wis., it is said, will soon be in the market for equipment for its new factory, which will include an engine, generator, boilers, motors and electric elevator.

OSHKOSH, WIS.—The Northern Hydro-Electric Power Company has been granted permission by the State Commission to issue $1,000,000 in bonds, the proceeds to be used to pay outstanding indebtedness; to construct dams at High and Johnson's falls on the Peshtigo River in Marinette County; also for the construction of power houses and substations and necessary equipment and for the purchase of right of way and erection of transmission lines, etc.

RACINE, WIS.—The F. J. Greene Engineering Works, which is erecting an extension to its plant, will require additional power equipment and is contemplating the installation of a gas producer, gas engine, electric generator and motors, but may install a boiler plant and Corliss engine.

SUPERIOR, WIS.—The Berwind Fuel Company, which is building a 600-ft. extension to its dock at Superior, Wis., is reported to have decided to install an electrical system for controlling unloading operations.

NELSON, B. C., CAN.—The Bull River Falls Power Company is reported to be building a large flume at Fort Steele which will provide for 10-000-hp at the lowest water periods.

VICTORIA, B. C., CAN.—The Vancouver Island Power Company is applying for permission to develop water power on the Jordan River.

VICTORIA, B. C., CAN.—The British Columbia Electric Company is asking permission to increase its capital by $2,500,000.

PHOENIX, B. C., CAN.—It is reported that the Canadian Pacific Railroad Company is considering the question of equipping its branch into Phoenix, to be operated by electricity.

BRACEBRIDGE, ONT., CAN.—The Town Council on Nov. 9 awarded contracts in connection with the additional electric power development at Wilson's Falls, as follows: For building dam, intake and power house foundations to the Canadian Contracts, Limited, of Toronto; water wheels to William Kennedy & Sons, of Owen Sound, and for electrical machinery to the Canadian General Electric Company, of Toronto.

BRANTFORD, ONT., CAN.—Dennie Hogan, of Brantford, is seeking to restrain the Council from carrying out the contract made with the Western Counties Power Companies to furnish electrical service in Brantford. Last January the ratepayers voted to authorize the City Council to enter into a contract for a term of five years with Western Counties Power Company, the local distribution end of the Cataract power system of Hamilton.

FORT FRANCIS, ONT., CAN.—The power dam has been completed, and the lighting load will be taken on within a month. The charge for power from this plant is $12 per hp per year.

INGERSOLL, ONT., CAN.—The purchasers of the plant and holdings of the South Western Traction Company have applied for a charter under the name of the London & Lake Erie Railway & Transportation Company. The new company proposes to build a railway to Ingersoll, where it will connect with the Ingersoll & Woodstock Railway. From Woodstock a road will be built to Brantford, where the railway company will get into connection with the Niagara Power Companies. The distribution of electricity is specially mentioned in its charter, and the company may prove a strong competitor of the Government line.

LONDON, ONT., CAN.—Proposals will be received by the city until Nov. 22 for transformers, motor-generator set, voltage regulators, switchboard, lightning protectors, instruments, arc and incandescent street lighting systems and other electrical equipment. E. L. Sifton is electrical engineer.

NORTH BAY, ONT., CAN.—The Nipissing Power Company has offered to pump the water for the town on a 10-year contract at 2 cents per thousand gallons or 2 cents per thousand for a stated amount and 1¾ cents per thousand for any in excess of this amount.

TORONTO, ONT., CAN.—A bill will be presented to the Dominion Parliament by F. L. Fowke, M.P., asking for a charter for the Toronto & Eastern Railway Company, which proposes to construct an electric railway connecting Cobourg and Toronto, passing through Port Hope, Newcastle, Bowmanville, Oshawa and Whitby.

TORONTO, ONT., CAN.—The Board of Control awarded the contracts for electric pumps for the city water works Nov. 10 as follows: Section A—To Iens Orten Boving, of London, Eng., for $14,800. Section B—To the Caledonia Iron Works for $11,703. Section C—To Iens Orten Boving, of London, Eng., for $6,500. Section D—To the Caledonia Iron Works at $7,385. Section E—To the Canadian General Electric Company for $4,882—making a total of $45,210.

MONTREAL, QUE., CAN.—Proposals will be received by the Saraguay Electric and Water Company for water tube boilers with a rating of 1000 hp. Charles Brandeis, of Montreal, is engineer.

MONTREAL, QUE., CAN.—The Canadian Light & Power Company is hurrying plans for its power development at the Beauharnois Canal. The present plans call for the installation of ten 5000-kw generators. Electricity generated at the plant will be transmitted to Montreal for distribution.

LA TUQUE, QUE., CAN.—The Quebec & St. Maurice Industrial Company has started work on the development of the Falls of the St. Maurice, at La Tuque, Quebec, where it is estimated that 50,000 hp can be developed. The power will be used to generate electricity to operate the pulp mills.

QUEBEC, QUE., CAN.—The Quebec Electric Railway is contemplating extending its system to Cape Rouge.

QUEBEC, QUE., CAN.—Articles of incorporation have been filed for the Quebec Railway, Light, Heat & Power Company, which is a consolidation of the Quebec Railway & Power Company, the Jacques Cartier Power Company, the Quebec Gas Company, the Frontenac Gas Company-the Canadian Electric Company, the Seven Falls Company and several smaller companies. The company is capitalized at $10,000,000.

QUEBEC, QUE., CAN.—The Canadian Westinghouse Company is installing an 8000-kw generator in the power house of the Shawinigan Water & Power Company. This addition will bring the output of the station up to 38,000 kw.

ST. TIMOTHEE, QUE., CAN.—The Nova Scotia Construction Company has been awarded a sub-contract amounting to approximately $200,000 in connection with the hydroelectric development of the Canadian Light & Power Company.

SHERBROOKE, QUE., CAN.—It is reported that the Sherbrooke Street Railway will shortly change hands. The Montreal Street Railway Company is said to be behind the deal and that options have been secured on several water power sites.

New Industrial Companies.

THE ELECTRIC DEVICE COMPANY, of Los Angeles, Cal., capitalized at $25,000, has been incorporated by F. A. Corbutt, E. J. Covington and S. C. Hall.

THE NATIONAL ELECTRIC DISPLAY COMPANY, of Fort Collins, Col., has been incorporated with a capital stock of $100,000 by W. C. Le Master, R. H. Snell, R. W. Lawson, H. B. Snell and H. P. Hurley.

THE PACIFIC ELECTRIC MOTOR COMPANY, of San Francisco, Cal., capitalized at $20,000 has been incorporated by W. A. L. Miller, O. W. Nordwell, J. W. Carmany, H. S. Meyer and A. P. Dessonslavy.

THE POSITIVE ELEVATOR SAFETY COMPANY, of New York, N. Y., has been chartered with a capital stock of $30,000 by A. W. Koening, of Orange, N. J.; H. L. Murdock, E. R. Huckel, of New York, N. Y. The company proposes to manufacture elevators and safety devices for elevators.

New Incorporations.

LA JARA, COL.—The La Jara Telephone Company has been chartered with a capital stock of $3,000 by Daniel E. Newcomb, Calvin L. Smith and William A. Braiden.

GAINESVILLE, GA.—The Lebanon Telephone Company has been organized by Homer Langford, Jesse L. Thompson, F. H. Hudgins and J. G. Allen.

MADISON, ILL.—The Madison Light Company has been incorporated with a capital stock of $10,000 by Andrew M. Lawrence, Roy D. Keehn and H. M. Campbell. The company proposes to generate and sell electricity for lamps and motors.

SHERIDAN, ILL.—The Fox River Hydro Electric Company has been incorporated with a capital stock of $54,000 by Jesse W. Carr, Robert J. Rowe. The company proposes to develop water-power to be utilized to generate electricity.

GESSE, IND.—The Citizens Telephone Company has filed articles of incorporation, capitalized at $30,000. The company proposes to build and equip a telephone exchange and system in Gesse and throughout Vermillion County. A. R. Peterson, A. W. Banks, W. F. Clem and F. L. Vawler are directors.

COVINGTON, KY.—Articles of incorporation have been filed for the Covington & Big Bone Railway Company for the purpose of constructing an interurban railway from Covington to the Big Bone Springs in Boone County, a distance of about 22 miles. The incorporators are: M. J. Crouch, J. J. Weaver, J. W. Kennedy, Orlando P. Schmidt, R. S. Holmes and others.

LYONS, NEB.—The Burt County Telephone Company has been incorporated with a capital stock of $100,000 by A. G. Hess, E. L. Whitman and others.

PAXTON, NEB.—Articles of incorporation have been filed for the Paxton & Sutherland Telephone Company with a capital stock of $5,000. The incorporators are: Howard Miles, H. D. Lute and others.

TRENTON, N. J.—The Great Falls Power Company has filed articles of incorporation with the Secretary of State with a capital stock of $17,000,000. The purpose of the company is to acquire and deal in water, water rights and power and to generate electricity by water power. The incorporators are: W. C. Parker, L. J. Relyea and F. W. Griswold. The office of the company is located at 76 Montgomery Avenue, Jersey City, N. J.

WALTON, N. Y.—The Citizens' Home Telephone Company has been incorporated with a capital stock of $100,000 for the purpose of operating in Delaware, Broome, Otsego, Chenango, Green, Schoharie, Ulster and Sullivan counues. The directors are: George O. Mead, of Walton, N. Y.; Theodore M. Brush and Irving H. Griswold, of Elyria, Ohio; Irving R. Coughley and George H. Rymers, of Albany, N. Y.

ATKINSON, N. C.—The Pender Telephone Company has been organized with a capital stock of $10,000 by E. E. Murphy and associates.

DOUGLAS, N. D.—Articles of incorporation have been filed for the Douglas Telephone Company by George W. Kinney, James Hanlon, A. Johnson and others. The company is capitalized at $25,000.

OKLAHOMA CITY, OKLA.—The Citizens Traction Company, of Oklahoma City, has been chartered with a capital stock of $300,000 for the purpose of building an electric interurban railway between Oklahoma City and Shawnee; Oklahoma City and Sulphur, 111 miles in length. The directors are: Alfred Hare, of Shawnee; John F. Winans, L. E. Patterson and W. F. Harn, of Oklahoma City, and H. S. Hurst, of Holdenville.

MART, TEX.—The Limeston Telephone Company has been incorporated with a capital stock of $4,500 by Richard Blackwood, E. F. King and F. B. Moore.

Personal.

MR. H. McL. HARDING delivered an illustrated lecture on "Electrical Transference and Transshipment of Freight at Railway and Water Terminals" before the Central Railway Club, Buffalo, N. Y., on Nov. 12.

MR. H. E. RICE, of the Philadelphia Electric Company, is acting as manager of the Electrical Exhibition Company of America, which is promoting the Philadelphia Electrical Show.

MR. HORATIO A. FOSTER is the author of a paper in the November issue of the *Journal* of the Franklin Institute entitled "Power House Economics in Baltimore."

MR. HARRY V. JAMISON has assumed charge of the department of advertising and printing of the American Sheet & Tin Plate Company, Pittsburgh, in place of Mr. Wilson, who has resigned on account of poor health.

MR. LEONARD S. HORNER has resigned his position with the Crocker-Wheeler Company as branch manager for the State of Connecticut and has joined the Acme Wire Company, of New Haven, Conn., as manager of sales.

MR. C. E. ELWELL, of San Francisco, has returned from a European trip, during which he purchased the American rights for the Poulsen system of wireless telegraphy. He has taken offices in the Foxcroft Building.

MESSRS. C. H. HUGHES & COMPANY, engineers, formerly at 120 Broadway, have moved to the U. S. Realty Building, 115 Broadway, New York, where they will continue their practice as engineers for electric railways and lighting companies.

MR. ROBERT J. McCUEN, superintendent of lamps and lighting of Baltimore, Md., has returned to his office after an illness of several weeks. He is now engaged, with Building Inspector Preston, on the location of a suitable site for a municipal lighting plant.

MR. C. E. ALLEN has been appointed to the transformer sales department of the Westinghouse Electric & Mfg. Company. Mr. Allen was formerly connected with the General Electric Company in a similar capacity, but resigned from that company during the past summer.

MESSRS. SMITH, KERRY & CHACE, whose head office is in Toronto, with a branch at Winnipeg, have recently opened a branch office in the Fairfield Building, Vancouver, B. C. Mr. H. J. Haffner is in charge of this branch. Considerable work on irrigation and hydroelectric projects is being handled.

MR. EDWARD P. THOMPSON has returned from a combined pleasure and business trip through Europe which has lasted for seven months. Mr. Thompson has removed his main office to Washington, owing to greater accessibility to the Patent Office, but until December his address will be Morristown, N. J.

HERRICK & STEBBINS.—A partnership for the practice of electrical engineering has been formed, with offices at 14 Church Street, New York, and under the firm name of Herrick & Stebbins, by Messrs. Albert B. Herrick, Theodore Stebbins, Clarence G. Boyden and John G. Rockwood. A feature of the practice will be physical reports based on continuously recorded measurements.

MR. J. KOBORI, M. E., chief electrical engineer of the Uji River Electric Company, Kyoto, Japan, has sailed for Europe after a stay of some weeks in this country, during which he consulted with manufacturers concerning machinery for the 40,000-kw Uji hydroelectric plant, eight miles from Kyoto. The work on the hydraulic system, which includes two tunnels, is now in progress. The greater part of the power developed will be transmitted at the generator voltage of 12,000 to Osaka, 22 miles distant.

MR. T. R. CUMMINS, formerly engineer of maintenance of way of the Chicago, Lake Shore & South Bend Railway, has become associated with Warwick, Mitchel & Company, chartered accountants, New York, and will devote his time to the valuation of engineering properties. Mr. Cummins was for seven years with the Illinois Central Railroad and for two and one-half years with J. G. White & Company, and for a time served as first-grade assistant engineer with the Isthmian Canal Commission at Panama.

MR. FRANK L. PERRY, of Chicago, who has a wide acquaintance among electrical men owing to a long connection with electrical journalism, is giving full swing to a long-standing liking for experimental research. He has a laboratory at his home, and the Chicago Sunday *Tribune* of Nov. 7 printed a two-page article based on his investigation of the possibilities of "wireless" in connection with aerial navigation. This article contained an announcement that will be of interest to Mr. Perry's electrical friends. "I am not ashamed to say," he is quoted, "that it is my hope to be able to spend the rest of my working life investigating electrical waves, pulses and mechanical oscillations, and seeking to make them do something practical and for the good of humanity that has not already been accomplished."

MR. SAMUEL INSULL is not often taken back; he is usually thoroughly at ease in any situation in which he finds himself. But he was completely surprised on Thursday of last week when about 25 members of his executive staff filed solemnly into his office in Chicago while he was discussing business affairs with Mr. Louis A. Ferguson, vice-president of the company of which Mr. Insull is the head. "What's this?" he inquired in some alarm, evidently fearing that something very unusual had happened. The visitors were the bearers of good tidings, however, for they had remembered Mr. Insull's fiftieth birthday, and the surprise was carefully planned. Mr. Ferguson rose to his feet when the invaders were lined up, and in a few earnest words told his dumbfounded chief that his men took a very real pleasure in signalizing the anniversary by uniting in a gift to a man whom they truly esteemed. He then handed Mr. Insull a watch. The recipient was so surprised that he could hardly speak, but he was immensely pleased, nevertheless, and he managed to return his thanks in accents that left no doubt of their sincerity. The watch is a very fine one, made by Patek, Philippe & Co., of Geneva, Switzerland. It is a split-second minute-repeater, having an open face and an 18-carat case. Inside the case is this inscription: "Samuel Insull, president Commonwealth Edison Company—From his advisory staff on his fiftieth birthday, November 11, 1909."

Trade Publications.

AUTOMATIC MOTOR-STARTING APPARATUS.—The Ward Leonard Electric Company, of Bronxville, N. Y., devotes sections A15 to A20 inclusive, in its new perpetual catalog, to automatic motor-starting apparatus for machine tool, open and closed tank and air compressor systems. These are new designs and new tabulated data are included in the sections.

BLUE PRINTING.—The Buckeye Engine Company, Salem, Ohio, has issued a pamphlet giving information concerning the rapid and economical production of blue prints. As illustrating the economy of the Buckeye electric blue printing machine a letter is reproduced from the Pittsburgh Gage & Supply Company relating to results obtained from the use of a Buckeye machine bought April 1, 1908. The machine cost $172.50, and paid for itself in 8 months, thus saving $21.50 per month. At this rate in the past 18 months the profit has been $387, or more than five times as much profit as made by the makers of the machine, which is still good for an indefinite time.

Business Notes.

THE CRESCENT COMPANY, 514 W. Monroe Street, Chicago, has been appointed agent for Central and Western States for the Cross staple.

THE BRYAN-MARSH COMPANY will establish a district office for the Pacific Slope. Mr. R. M. Cole recently visited San Francisco to complete the details.

MR. J. E. LAUNDER, secretary and treasurer of the Independent Electric Machinery Company, of Kansas City, Mo., is on a business trip visiting Chicago, Springfield, Mansfield, Ohio, and St. Louis in the interest of his company, which is Western distributor for the Ideal Electric & Manufacturing Company, of Mansfield, Ohio, for its line of alternating and direct-current motors and generators. Mr. Launder reports business very good in the Central West, the factories working 15 hours per day trying to keep up with orders.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 9, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

939,217. MANUFACTURE OF CEMENT; S. O. Cowper-Coles, Westminster, London. App. filed Jan. 17, 1908. Makes Portland cement from blast furnace flag by subjecting the fused mixture to an electric current of high temperature.

939,223. PROCESS OF ELECTROLYTICALLY REMOVING IRON-OXIDE SCALE; Charles W. Danforth and Noble Jones, Sharon, Pa. App. filed June 25, 1909. Process of electrolytically removing iron oxide scale from iron by subjecting the same as a cathode to an electric current while submerged in a solution containing by-sulphate of an alkaline metal in water.

939,224. PROCESS OF ELECTROLYTICALLY REMOVING IRON-OXIDE SCALE; Charles W. Danforth and Noble Jones, Sharon, Pa. App. filed Aug. 28, 1909. See 939,223. The solution consists of the by-sulphate of an alkaline metal dissolved in diluted sulphuric acid.

939,258. ELECTRIC SWITCH; F. Hoerle, Plainville, Conn. App. filed Nov. 12, 1907. A snap switch having a pivoted arm oscillating between contacts for motor carriages, etc., the base carrying a slot with the switch carrying post fitting the slot.

939,292. TEST FOR FIRE ALARM APPARATUS; J. G. Nolen, Chicago, Ill. App. filed Sept. 24, 1903. A normally wound master signaling device normally closing the circuit, a test device comprising a circuit breaker and short circuiting means for the circuit breaker when the master signaling device is run down to predetermined degree.

939,293. FIRE PROTECTION SIGNAL SYSTEM; J. G. Nolen and J. E. Shepard, Chicago, Ill. App. filed April 25, 1904. Includes a water tank and a float valve, a sprinkler and a signal system associated with the water tank float, with a battery and circuit connections.

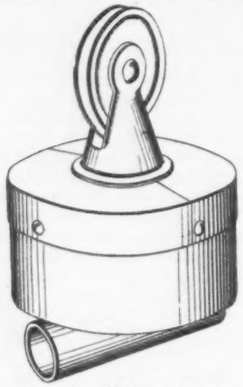
939,331. ALTERNATING-CURRENT ELECTRIC MOTOR; J. T. Schaaff, Washington, D. C. App. filed March 9, 1906. Includes a plurality of separate electrical magnets spaced apart, a single armature actuated thereby and a phase retarder in the circuit of one magnet.

939,338. ELECTRICAL TRANSMISSION OF GRAPHIC MESSAGES; G. Sellers, Chicago, Ill. App. filed July 18, 1908. Improvement in selenium cell apparatus. Makes use of a light chamber, a slotted aperture in the chamber, a source of light, a series of revolving cells located above the aperture, a motor and means for moving a message strip below the aperture and above the source of light.

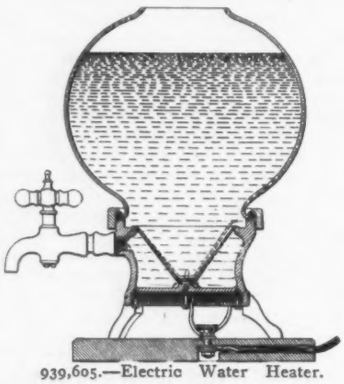
939,339. ELECTRIC TRANSMISSION OF MESSAGES; G. Sellers, Chicago, Ill. App. filed Nov. 25, 1908. Makes uses of transparent cylinder of glass rotated by a motor, the message being wrapped around the motor and a pencil of light passing through the message. This strikes an electrical conductor within the cylinder whose resistance varies according to the amount of light received. The conductor forms part of the local circuit which operates an electric motor for moving the cylinder with its message sheet.

939,370. BLOCK SIGNALING APPARATUS; S. A. Wood, Providence, R. I. App. filed May 14, 1906. A target arm with magnetically actuated means for actuating the target operating means.

939,383. ELECTRIC TRANSMITTER; B. F. Bellows, Cleveland, O.



939,564.—Trolley Head.



939,605.—Electric Water Heater.

App. filed July 29, 1907. A semi-automatic transmitter for making a succession of short impulses by a single movement of the key. Uses a vibrator carrying a weight, which continues its vibration when started.

939,401. TELEGRAPH SYSTEM AND APPARATUS; T. B. Dixon, New York, N. Y. App. filed Nov. 25, 1904. Multiplex telegraph for transmitting a plurality of distinct and separate messages over a single wire. Transmits one message by a weak current, two other messages by stronger impulses in pairs, the one message being transmitted by positive impulses and the other by negative.

939,409. ELECTROMAGNET RELAY; D. I. Garretson, New York, N. Y., and Marcus O. Anthony, Englewood, N. J. App. filed Oct. 27, 1908. For telegraphs. Uses an elastically mounted contact connected to an armature, a stationary contact and an electromagnet so located that the armature may approach the magnet pole pieces without touching them.

939,439. TELEPHONE ATTACHMENT; H. R. Palmer, Seattle, Wash. App. filed March 3, 1908. The receiver of a desk set is adjustable to sustain itself in proper relation to the ear by means of a clip and strap, the receiver being mounted upon a tubular standard made of telescopic sections.

939,441. APPARATUS FOR PRODUCING ELECTRIC DISCHARGES; H. Pauling, Gelsenkirchen, Germany. App. filed Dec. 18, 1905. For treating gases by stationary electrodes separated to prevent ignition and a conductor successively passing the electrodes, thus increasing and decreasing the distance between the electrodes and blast pipes which extinguish the discharges.

939,442. PROCESS FOR PRODUCTION OF VOLTAIC HIGH CURRENT ARCS; H. Pauling, Gelsenkirchen, Germany. App. filed Aug. 13, 1906. For treating gases. The arcs are elongated by causing them to move along the electrodes and by passing the gas to be acted upon in an inclined direction against each other, meeting in the plane of the electrodes.

939,501. COUPLING FOR ELECTRIC CONDUCTORS; J. L. Hinds, Syracuse, N. Y. App. filed April 1, 1909. The ends of the conductor pass into a compressible sleeve surrounded by sleeve nuts which compress the sleeve against the conductor.

939,507. TELEGRAPH SENDING MACHINE; J. A. Hulit, Topeka, Kan. App. filed Sept. 3, 1908. An automatic telegraph sender driven by a motor which runs only during the transmission of a signal and operates a mechanism making dots, with which a mechanism is associated for making dashes, the spaces being always the same.

939,523. MAGNETIC ORE SEPARATOR; W. D. Ludwick, Seattle, Wash. App. filed Sept. 22, 1906. A pan, a rotating drum, with part of its periphery enclosed by the pan and rotating electromagnets carried by the drum, with means for supplying and removing ore to and from the pan.

939,564. TROLLEY-HEAD; T. R. Stam, West Union, Ia. App. filed April 13, 1909. The wheel is so mounted with respect to the body that it rights itself. It is mounted on a turntable.

939,599. TWO-POLE SNAP SWITCH; L. Kellner, New York, N. Y. App. filed Dec. 5, 1908. Insures a 90-deg. throw, thus securing the greatest possible break in the circuit. Uses a detent arm engaged by a spring and having pins which permit a limited longitudinal movement of the sleeve which turns the switch elements.

939,605. ELECTRIC WATER HEATER; Henri G. Levy and Geo. N. Blanchard, San Francisco, Cal. App. filed March 29, 1909. A reservoir having a bottom with a recess, a heating coil therein and an inverted conical valve in the reservoir.

939,625. APPARATUS FOR STRENGTHENING WEAK ELECTRICAL CURENTS; A. Pollak, Paris, France. App. filed Aug. 7, 1908. A telephone repeater in which a movable coreless coil is introduced into a magnetic field and attached to the membrane of a microphone, and the current passing through the microphone is passed through a second strengthening coil, using a single magnet for both coils.

939,626. ELECTRICALLY ACTUATED TRAIN SWITCH; J. Y. Porter, Detroit, Mich. App. filed Dec. 10, 1908. For trolley roads in which the current may be used to shift the switch. Controlled by the motorman.

939,650. ELECTRICAL CONTROLLING SYSTEM FOR ROLLING OR SLIDING SHUTTERS, ELEVATORS, ETC.; L. G. Wilson, Larchmont, N. Y. App. filed May 23, 1908. A shunt-wound electric motor drives a vertically movable shutter and is controlled by a knife switch.

939,658. TROLLEY HEAD; J. J. Bennett, Pittsfield, Mass. App. filed Dec. 3, 1907. The wheel is carried by the fork at the top of the post, so arranged as to rotate about a vertical axis when a car passes a curve.

939,659. RAILWAY TRAFFIC CONTROLLING SYSTEM; H. Bezer, Newark, N. J. App. filed Jan. 18, 1907. A main railway line, with a track switch, a signaling system controlling the traffic, a movable member controlling the signaling system, an electro-translative magnet controlling the member, the magnet being in the rail circuit, which circuit includes a pole changer, the track switch and the pole changer acting in conjunction.

939,672. ANNUNCIATOR CASE; H. D. Crouch, Montreal, Canada. App. filed March 25, 1907. A waterproof case for shipboard use, the meeting edges being watertight, and watertight plates dividing it into compartments.

939,683. TELEGRAPH TRANSMITTER; G. M. Goddard, Rutland, Vt. App. filed May 29, 1908. Includes a keyboard which controls cams which control a telegraph key lever, the cams being provided with character faces and being connectable with the shaft by a clutch.

939,689. COUPLING FOR ELECTRIC CONDUCTORS; J. L. Hinds, Syracuse, N. Y. App. filed April 1, 1909. Comprises an outer section, an inner section and a compressible sleeve. Receives the ends of the electric conductors.

939,708. MERCURY AND OTHER VAPOR ELECTRIC LAMP; H. A. Kent, Bound's Green, and H. G. Lacell, Finchley, Eng. App. filed Dec. 1, 1908. The negative electrode and the positive electrode are closely adjacent so as to keep their temperatures substantially equal, and the negative electrode is heated to prevent the cooling and condensing of the mercury.

939,719. REMOTE ELECTRIC CONTROL SYSTEM FOR SEARCHLIGHTS AND THE LIKE; A. LeBlanc, New York, N. Y. App. filed Feb. 5, 1909. Means for starting, stopping, reversing, regulating and controlling the direction and speed of the motors which operate the gears that manipulate the searchlight.

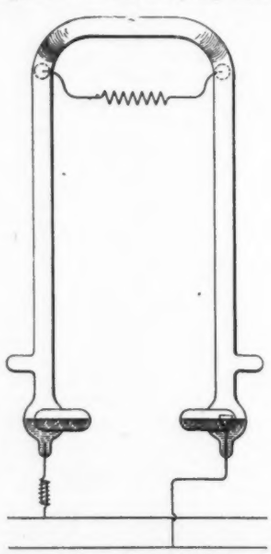
939,723. ELECTRIC MOTOR FAN; N. A. Locke, Fulton, N. Y. App. filed Jan. 27, 1908. A motor fan with a frame and a vane wheel with a power transmission between the motor and the wheel and a switch for the motor, the frame in the wheel being movable toward and from each other by the switch.

939,730. AUTOMATIC ELECTRIC CURRENT BREAKER; W. F. Meter and W. L. Rideout, Oshkosh, Wis. App. filed July 22, 1908. A switch, an electromagnet which opens the switch and breaks its own circuit before the switch contacts are broken and a non-inductive shunt for the magnet.

939,756. TELEPHONE SYSTEM; F. E. Summers, Scotland County, Mo. App. filed March 10, 1908. For permitting two parties to communicate and prohibiting the others from overhearing the conversation.

939,791. SELF-WINDING MECHANISM; A. D. Blodgett, Newton, and F. S. Atkinson, Brookline, Mass. App. filed March 1, 1909. For clocks. The winding is accomplished by an electromagnet which winds a spring and is intermittently excited.

939,863. ELECTRIC SWITCH; J. H. Rusby, Nutley, N. J. App. filed Feb. 22, 1907. Push-button snap switch having an actuating finger piece with a one-piece lever and a spring surrounding it, together



939,912.—Gas or Vapor Electric Lamp.

with a latch piece and a blade actuating piece, having an extension engaged by the spring.

939,910. MAGNETO GENERATOR; R. H. Hassler, Indianapolis, Ind. App. filed March 23, 1908. For producing the igniting spark in a gas engine in which a high number of alternations are produced at a low armature speed, by providing a series of magnets forming a multipolar field. Also improves the lubricating means.

939,912. GAS OR VAPOR ELECTRIC LAMP; P. C. Hewitt, New York, N. Y. App. filed June 29, 1905. For starting vapor lamps by passing the starting current between the electrodes within the container for a portion of the way adjacent to the electrodes and for the remainder of the way passing the current outside of the container.

939,957. THERMOSTAT; H. G. Geissinger, West Orange, N. J. App. filed Nov. 30, 1908. A straight flexible member which is normally arched; with two other flexible members, one on each side and having a different rate of thermic expansion therefrom, together with connecting devices connecting the ends of the members.